

# Construction of an Angle Bisector

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**Theorem 11.1.** It is possible to construct an angle bisector using a compass and a straight edge given an angle A.

*Proof.* Draw a circle around the vertex of angle A that intersects the rays of the angle. Label the points of intersection X and Y. Draw a circle around X that goes through Y and a circle around Y that goes through X. Label the point where they intersect D. Draw line segment AD. Segment AD is the angle bisector of angle A.

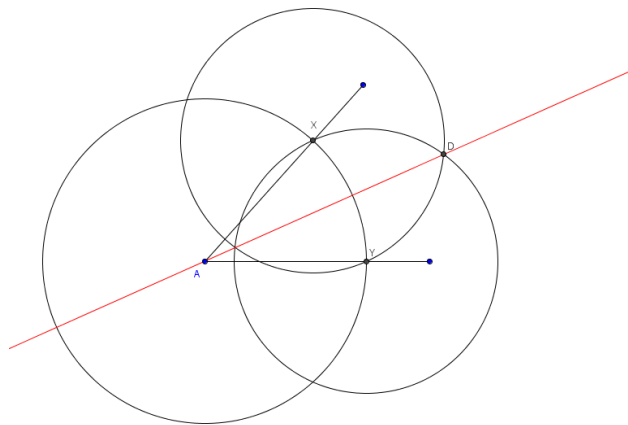


Figure 1: Angle Bisector

To show that this is, in fact, an angle bisector, draw segments XD and YD. Segment XD is a radius of circle XY and segment YD is a radius of circle YX. Circle XY and YX are congruent because they share radius length XY, therefore segments XD and YD are congruent. Segments AX and AY are congruent because they are radii of the circle around vertex A. Triangles AXD and AYD share side AD. Since segment XD is congruent to segment YD, segment AX is congruent to segment AY, and side AD is shared, triangle AXD is congruent to triangle AYD by Euclid I.8. Since triangles AXD and AYD are congruent then we know angle XAD is congruent to its corresponding angle YAD. Therefore, segment AD is the angle bisector of angle A.

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