Chapter 3—Constructions: Part 1

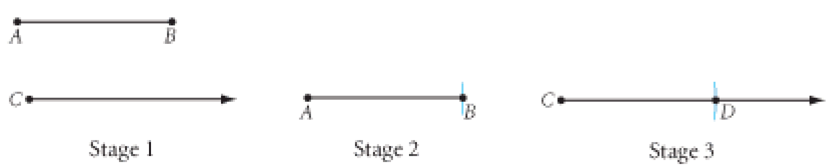
In this lesson you will:

- learn what it means to create a geometric construction
- duplicate a segment and an angle using a straightedge and a compass
- construct a perpendicular bisector and a perpendicular to a line from a point not on the line

The compass, like the straightedge, has been a useful geometry tool for thousands of years. The ancient Egyptians used the compass to mark off distances. During the Golden Age of Greece, Greek mathematicians made a game of geometric constructions using only a compass and a straightedge.

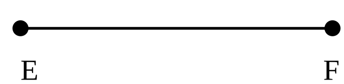
In the previous chapters, you drew and sketched many figures. In this chapter, however, you'll **construct** geometric figures. The words *sketch*, *draw*, and *construct* have specific meanings in geometry. *Sketch* means you ______________. You don't need to use any geometry _________. *Draw* means you should draw carefully and _______________, using _______________ and ____________. *Construct* means you must only use a ___________ and a __________________. When you see the word "duplicate," it means to **construct**.

Investigation 3.1: "Duplicating a Segment and Duplicating an Angle"

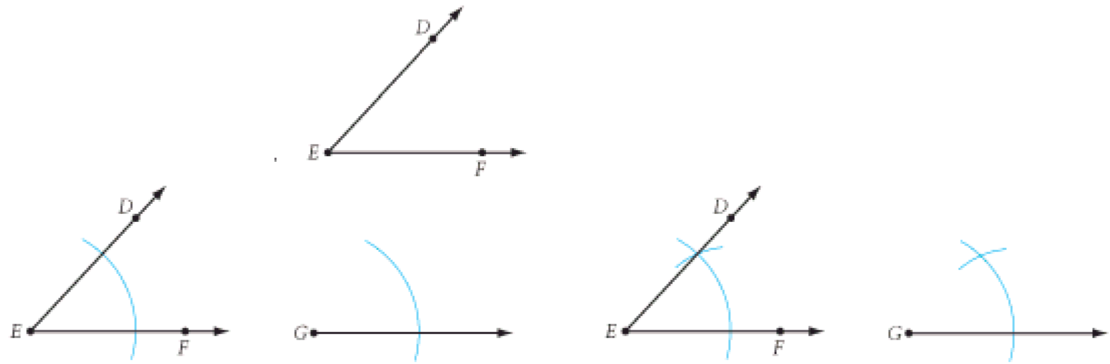


A.) The complete construction for copying a segment, $\overline{AB}$, is shown above. Describe each stage of the process.

B.) Using the same process, duplicate segment EF.



Next, we will learn to duplicate an angle.

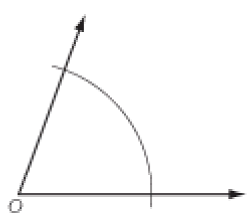


Stage 1 Stage 2

C.) The first two stages for copying $\angle DEF$ are shown above. Describe each stage of the process.

D.) What will be the final stage of the construction?

E.) Using the same process, duplicate the following angle.



Investigation 3.2: “Constructing the Perpendicular Bisector”

*Add “segment bisector” and “perpendicular bisector” to your dictionary. Also add the following conjectures to your conjecture list.

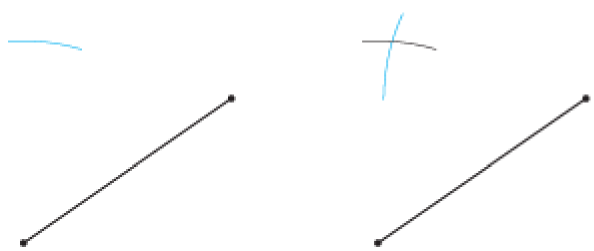
Perpendicular Bisector Conjecture (C-5)

If a point is on the perpendicular bisector of a segment, then it is __________________ from the endpoints.

Converse of the Perpendicular Bisector Conjecture (C-6)

If a point is _________________ from the endpoints of a segment, then it is on the perpendicular bisector of the segment.

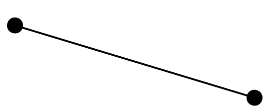
♦ **equidistant**: the same distance



Step 1 Step 2

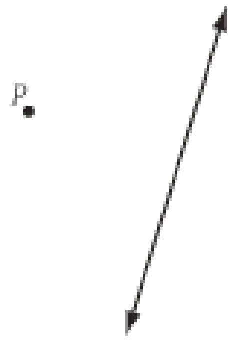
A.) The first two steps of constructing a perpendicular bisector are above. Describe the two steps.

B.) Do the same two steps as above, but on the other side of the segment.
C.) Draw a line through the two points found by the intersecting arcs. This is the perpendicular bisector.
D.) Construct the perpendicular bisector of the segment below.



Investigation 3.3: "Constructing Perpendiculars to a Line"

You already know how to construct perpendicular bisectors of segments. You can use that knowledge to construct a perpendicular from a point to a line.

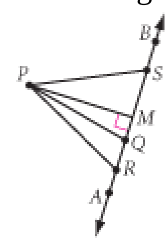


A.) Step 1: Swing equal arcs from *P* that intersect the line on both "sides" of *P*. Label the two points *A* and *B*.

B.) How is *PA* related to *PB*? What does this tell you about where point *P* lies? (Hint: See Conjecture C-6.)

C.) Construct the perpendicular bisector of $\overline{AB}$. (You already have the point on one side (*P*), so you just need to find the point on the other side.) Label the midpoint of $\overline{AB}$ as *M*.

D.) Suppose we labeled 3 randomly placed points on $\overleftrightarrow{AB}$ as *Q*, *R*, and *S*. See the graph below. Which distance is the shortest?



Based on this observation, complete the conjecture below, and then add it your conjecture list.

Shortest Distance Conjecture (C-7)

The shortest distance from a point to line is measured along the ___________________ segment from the point to the line.

⇒**ASSIGNMENT**: ____