EXTEND 11-1

Geometry Lab
Constructing Angles and Lines

A compass is a drawing instrument used for drawing circles and arcs. A straightedge, such as a ruler, is used to draw segments. You can use a compass and a straightedge to construct basic elements of geometric figures.

You know a line segment is part of a line with two endpoints. Line segments that have the same length are called **congruent segments**.

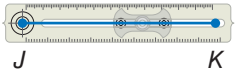
Activity 1 Construct Congruent Segments

Step 1

Draw $\overline{JK}$. Then use a straightedge to draw a line segment longer than $\overline{JK}$. Label it $\overline{LM}$.

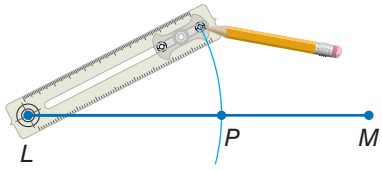
Step 2

Place the compass at J and adjust the compass setting so you can place the pencil tip on K. The compass setting equals the length of $\overline{JK}$.



Step 3

Using this setting, place the compass tip at L. Draw an arc to intersect $\overline{LM}$. Label the intersection P. $\overline{LP}$ is congruent to $\overline{JK}$.

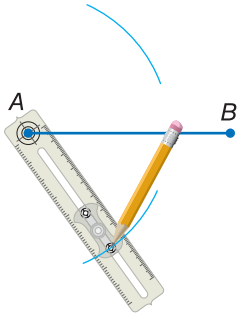


A **perpendicular bisector** is a perpendicular line that divides a line segment into two congruent segments.

Activity 2 Construct Perpendicular Bisectors

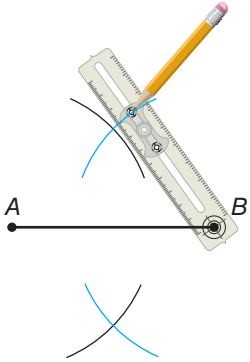
Step 1

Draw $\overline{AB}$. Then place the compass at point A. Using a setting greater than one half the length of $\overline{AB}$, draw an arc above and below $\overline{AB}$.



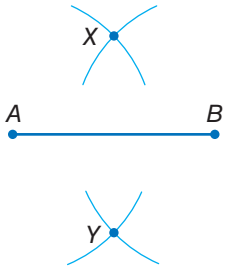
Step 2

Using this setting, place the compass at point B. Draw another set of arcs above and below $\overline{AB}$ as shown.



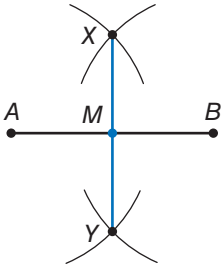
Step 3

Label the intersection of these arcs X and Y as shown.



Step 4

Draw $\overline{XY}$. Label the intersection of $\overline{AB}$ and this new line M.



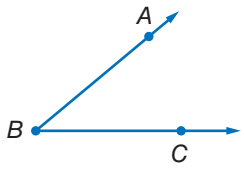
$\overline{XY}$ is the perpendicular bisector of $\overline{AB}$. Segments AM and MB are congruent.

Two angles that have the same measure are **congruent angles**. You can use a protractor to construct congruent angles.

Activity 3 Construct Congruent Angles

Step 1

Draw $\angle ABC$.

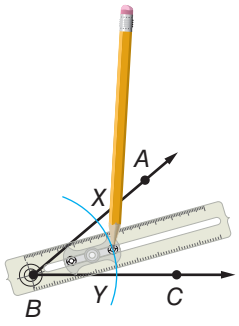


Step 2

Use a straightedge to draw $\overleftrightarrow{LK}$.

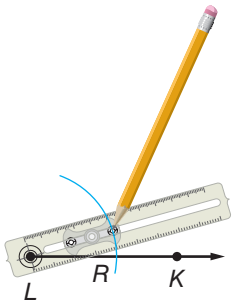
Step 3

With the compass at point B, draw an arc that intersects both sides of $\angle ABC$. Label the two points of intersection as X and Y.



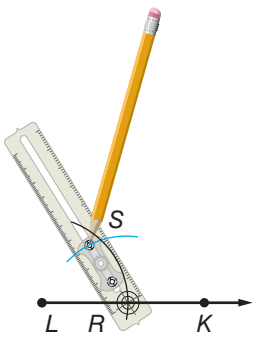
Step 4

With the same setting on your compass, place your compass at point L. Draw an arc. Label the intersection R.



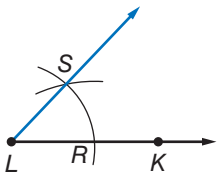
Step 5

Open your compass to the same width as the distance between points X and Y. Then place the compass at point R. Draw an arc that intersects the arc you drew in Step 4. Label this point of intersection S.



Step 6

Use a straightedge to draw a ray from L through point S.



Angle MLK is congruent to $\angle ABC$.

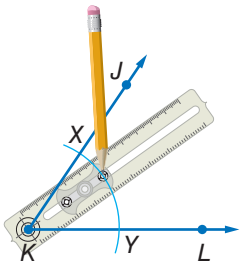
Geometry Lab
Constructing Angles and Lines *Continued*

An **angle bisector** is a ray that divides an angle into two congruent angles.

Activity 4 Construct an Angle Bisector

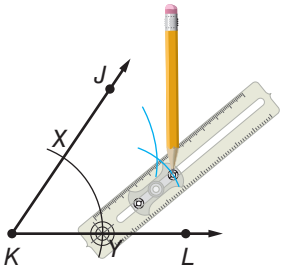
Step 1

Draw $\angle JKL$. Place the compass at point K and draw an arc that intersects both sides of the angle. Label the intersections X and Y.



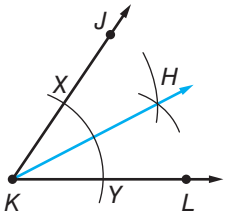
Step 2

With the compass at point X, draw an arc in the interior of $\angle JKL$. Using this setting, place the compass at point Y. Draw another arc.



Step 3

Label the intersection of these arcs H. Then draw $\overrightarrow{KH}$.



$\overrightarrow{KH}$ is the bisector of $\angle JKL$. Angles JKH and HKL are congruent.

Recall that two lines in a plane that never intersect are parallel lines. You can use angle constructions to construct a line parallel to a given line.

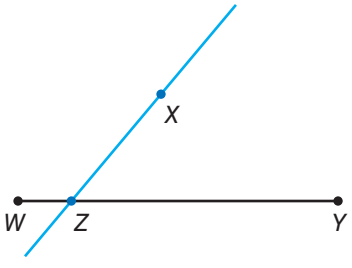
Activity 5 Construct Parallel Lines

Step 1

Draw $\overline{WY}$. Draw point X above the line.

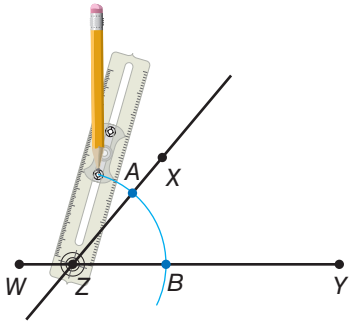
Step 2

Use a straightedge to draw a line through point X to intersect $\overline{WY}$ at an acute angle. Label this intersection point Z.



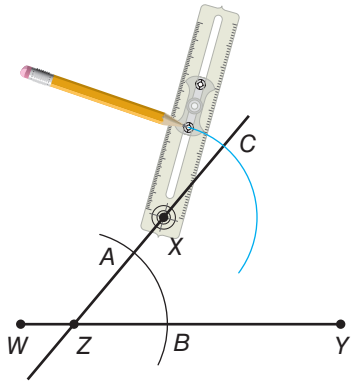
Step 3

Place the compass at point Z. Using a setting about one half the length of $\overline{XZ}$, draw an arc to intersect both sides of the angle. Label the intersections A and B.



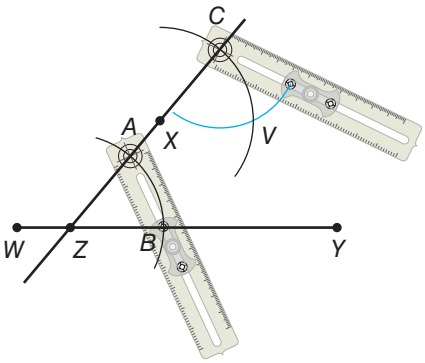
Step 4

Using the same setting, place the compass on point X. Draw an arc about the same size. Label the intersection as C.



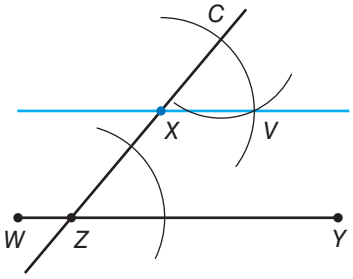
Step 5

Open your compass to measure the distance from A to B. Using that same setting, place the compass on C. Draw another arc that intersects the arc drawn in Step 4. Label this intersection point V.



Step 6

Use a straight edge to connect points X and V. Line XV is parallel to $\overline{WY}$.



Segment WY is parallel to line XV.

Exercises

Trace each segment. Then construct the segment's perpendicular bisector and a segment congruent to it.

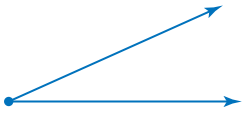
1.

2.

3.

Trace each angle. Then construct the angle's bisector and an angle congruent to it.

4.



5.

6.

Trace each segment. Then construct a line parallel to it.

7.

8.

9.

Identify each of the following in the figure at the right.

10. perpendicular bisector of $\overline{CG}$

11. angle bisector of $\angle AIG$

12. segment congruent to $\overline{IC}$

13. angle congruent to $\angle EID$