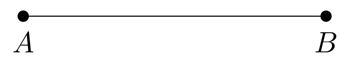
MA 202: Construction Techniques

03/22/2018

I Copying Segments and Angles

1. Construct a copy of line segment $\overline{AB}$:

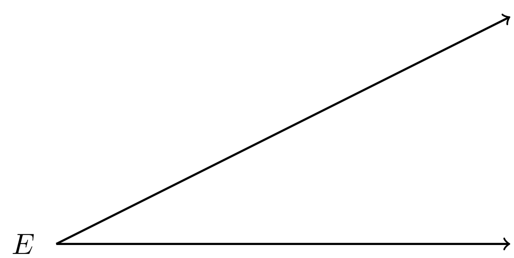


   (a) Draw a point and label it C. Use the straight edge to draw a ray beginning at C.

   (b) Use the compass to measure the length of $\overline{AB}$. Transfer this length to the ray in part (a) by placing the needle on C and marking D.

   Justification of the Technique: Why is $\overline{CD}$ an exact copy of $\overline{AB}$?

2. Construct a copy of angle E:



   (a) Draw a point and label it G. Use the straight edge to draw a ray beginning at G.

   (b) Use the compass to draw an arc with center at E, and copy this arc with center at G. Label the point of intersection of the arc and the ray H.

   (c) Use the compass to measure the length between the sides of angle E where it intercepts the arc. Use this length to draw an arc with center at H.

   (d) Use the straight edge to draw a ray from G through the intersection of the arcs.

   Justification of the Technique: Why is angle E an exact copy of angle G?

II Constructions Involving Parallel Lines

1. Construct a line that is parallel to $\overline{AB}$ and goes through point P:

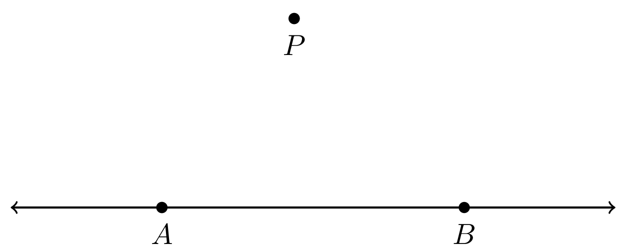
   (a) Draw a line through A and P.

   (b) Use the compass to draw an arc with center at A so that it crosses both $\overline{AB}$ and $\overline{AP}$. Label the points of intersection C and D respectively.

   (c) Copy angle $\angle PAB$ onto the line $\overline{AP}$. To do this, draw an arc with center at P using the same radius as in (b). Label the point of intersection of the arc and the line $\overline{AP}$ as Q. Using the distance between C and D, draw an arc centered at Q. Label the point of intersection of the two arcs as R. Now we have angle $\angle QPR$.

   (d) Draw a line going through P and R. Now $\overline{PR}$ is parallel to $\overline{AB}$.

   Justification of the Technique: Why is the line $\overline{PR}$ parallel to $\overline{AB}$?



2. Construct a parallelogram:

   (a) Draw an angle and label the vertices A, B, and C.

   (b) Use the compass to measure the length of $\overline{BC}$ then use this length to draw an arc with center at A.

   (c) Use the compass to measure the legnth of $\overline{AB}$ then use this length to draw an arc with center at C.

   (d) Label the intersection of the two arcs at D. Draw lines $\overline{AD}$ and $\overline{CD}$. $ABCD$ is a parallelogram.

   Justification of the Technique: Why is $ABCD$ a parallelogram?

III Constructing Line Segments and Angle Bisectors

Definition: A line is a perpendicular bisector of a line segment when:

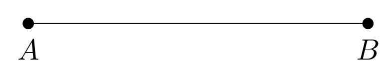
1. Construct a perpendicular bisector to $\overline{AB}$.

   (a) Set the radius of the compass so that is is greater than one-half the length of $\overline{AB}$. Draw arcs with centers at A above and below $\overline{AB}$.

   (b) Using the same radius as in part (a), draw arcs with centers at B above and below $\overline{AB}$.

   (c) Draw the line that passes through the intersections of the arcs. This line is the perpendicular bisector of $\overline{AB}$.

   Justification of the Technique: Why does this line bisect $\overline{AB}$ and why is it perpendicular to $\overline{AB}$?



Definition: The angle bisector of an angle is:

2. Construct the angle bisector of angle J.

   (a) Draw an arc with center at J. Label the intersections of the arc and the rays of the angle as K and L.

   (b) Draw an arc with center at K. Then use the same radius to draw an arc with center at L.

   (c) Label the intersection of the two arcs from part (b) M. Draw a line from J through M. This is the angle bisector of angle $\angle KJL$.

   Justification of Technique: Why does $\overline{JM}$ bisect $\angle KJL$?