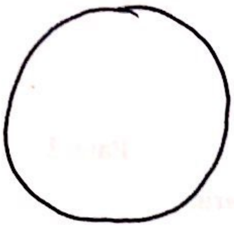
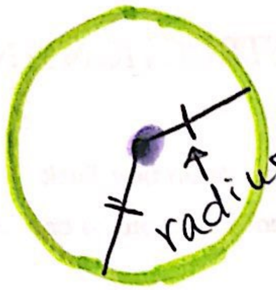
Draw vs. Construct

"Free hand"

"precise"



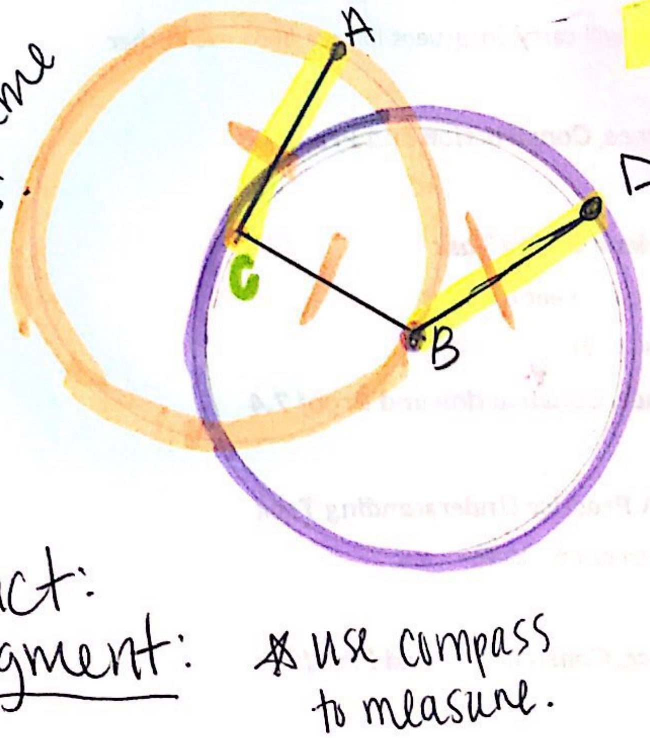


← used our compass

Every point on our circle is the same distance from center.

Construction: create geometric figures using a compass and straightedge.

* Circles share same radius!



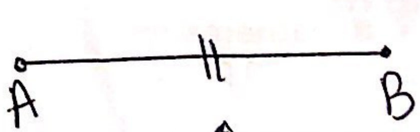
Is $\overline{AC} \cong \overline{BD}$?

congruent: equal/same length

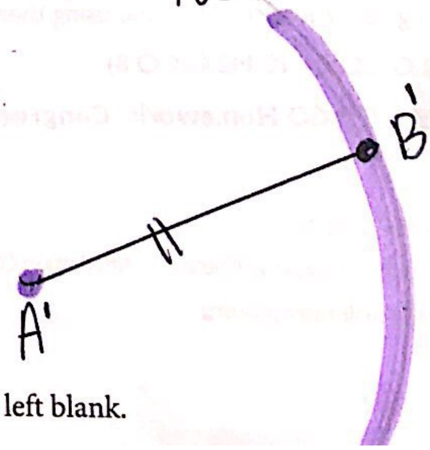
yes, because the are the same radius

Construct:
Line Segment:

* use compass to measure.



congruency marks!



put B anywhere on circle!

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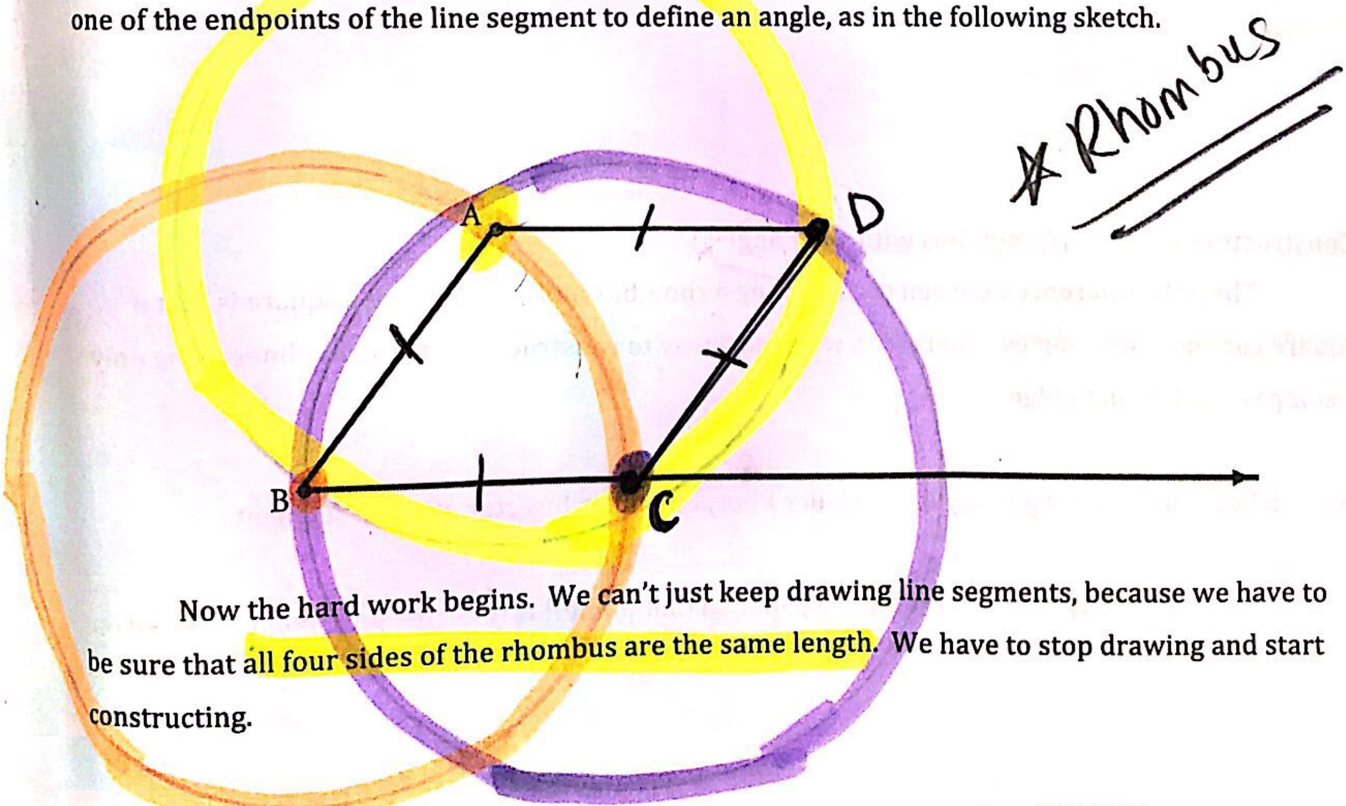
7.1 Under Construction

A Develop Understanding Task

Anciently, one of the only tools builders and surveyors had for laying out a plot of land or the foundation of a building was a piece of rope.

There are two geometric figures you can create with a piece of rope: you can pull it tight to create a line segment, or you can fix one end, and—while extending the rope to its full length—trace out a circle with the other end. Geometric constructions have traditionally mimicked these two processes using an unmarked straightedge to create a line segment and a compass to trace out a circle (or sometimes a portion of a circle called an arc). Using only these two tools you can construct all kinds of geometric shapes.

Suppose you want to construct a rhombus using only a compass and straightedge. You might begin by drawing a line segment to define the length of a side, and drawing another ray from one of the endpoints of the line segment to define an angle, as in the following sketch.



Now the hard work begins. We can't just keep drawing line segments, because we have to be sure that all four sides of the rhombus are the same length. We have to stop drawing and start constructing.

Constructing a rhombus

Knowing what you know about circles and line segments, how might you locate point C on the ray in the diagram above so the distance from B to C is the same as the distance from B to A?

#$\overline{BC} \cong \overline{BA}$
→ same radius

1. Describe how you will locate point C and how you know $\overline{BC} \cong \overline{BA}$, then construct point C on the diagram above.

- Measured the distance from A to B with our compass.
- Started at B using the same distance with our compass to mark the ray (C)

Now that we have three of the four vertices of the rhombus, we need to locate point D, the fourth vertex.

2. Describe how you will locate point D and how you know $\overline{CD} \cong \overline{DA} \cong \overline{AB}$, then construct point D on the diagram above.

- Use same side length for radius and make a circle from each vertice
- Find D where the circles intersect
- Congruent because we have the same radius.

Constructing a Square (A rhombus with right angles)

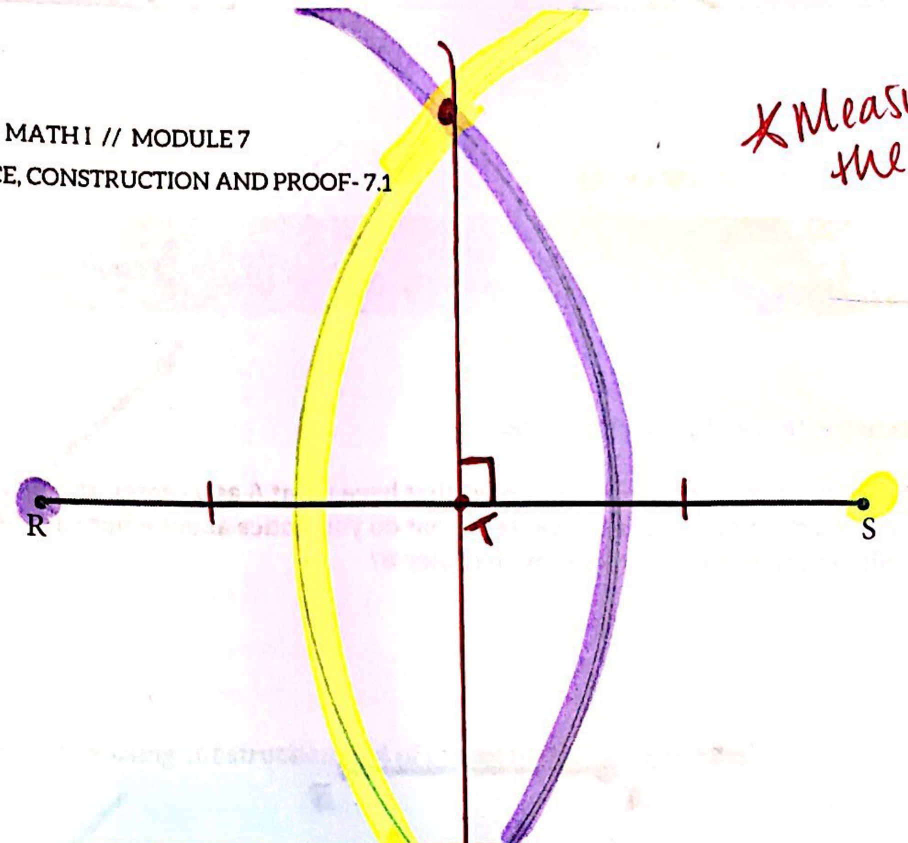
The only difference between constructing a rhombus and constructing a square is that a square contains right angles. Therefore, we need a way to construct perpendicular lines using only a compass and straightedge.

We will begin by inventing a way to construct a perpendicular bisector of a line segment.

3. Given $\overline{RS}$ below, fold and crease the paper so that point R is reflected onto point S. Based on the definition of reflection, what do you know about this "crease line"?

- Bisects $\overline{RM} \cong \overline{MS}$
- Perpendicular, so we form a Right Angle

*Measure past the middle!!



You have "constructed" a perpendicular bisector of $\overline{RS}$ by using a paper-folding strategy. Is there a way to construct this line using a compass and straightedge?

4. Experiment with the compass to see if you can develop a strategy to locate points on the "crease line". When you have located at least two points on the "crease line" use the straightedge to finish your construction of the perpendicular bisector. Describe your strategy for locating points on the perpendicular bisector of $\overline{RS}$.

Now that you have created a line perpendicular to $\overline{RS}$ we will use the right angle formed to construct a square.

5. Label the midpoint of $\overline{RS}$ on the diagram above as point M. Using segment $\overline{RM}$ as one side of the square, and the right angle formed by segment $\overline{RM}$ and the perpendicular line drawn through point M as the beginning of a square. Finish constructing this square on the diagram above. (Hint: Remember that a square is also a rhombus, and you have already constructed a rhombus in the first part of this task.)