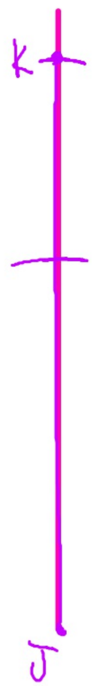
Lesson 1-2

Measuring and Constructing Segments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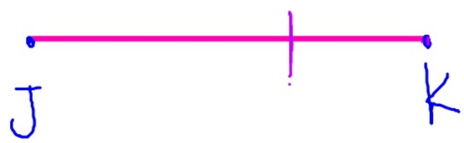
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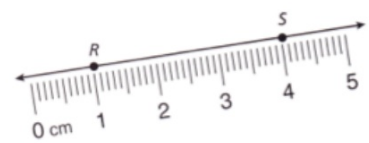
Measuring and Constructing Segments

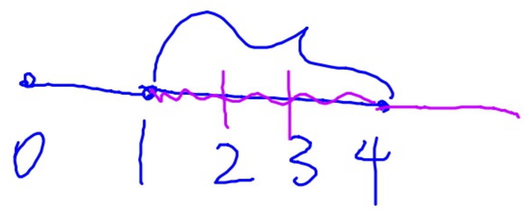
Going Deeper

Essential question: *What tools and methods can you use to copy a segment, bisect a segment, and construct a circle?*

The **distance along a line** is undefined until a unit distance, such as 1 inch or 1 centimeter, is chosen. By placing a ruler alongside the line, you can associate a number from the ruler with each of two points on the line and then take the absolute value of the difference of the numbers to find the distance between the points. This distance is the **length** of the segment determined by the points.

In the figure, the length of $\overline{RS}$, written RS, is the distance between R and S. $RS = |4 - 1| = |3| = 3$ cm.





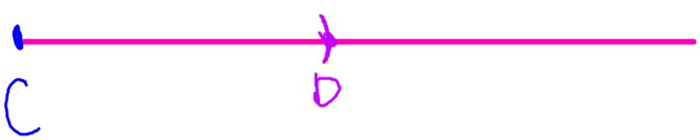
A *construction* is a geometric drawing that uses only a compass and a straightedge. You can construct a line segment whose length is equal to that of a given segment by using only these tools.

CC.9–12.G.CO.12

1 EXAMPLE Copying a Segment

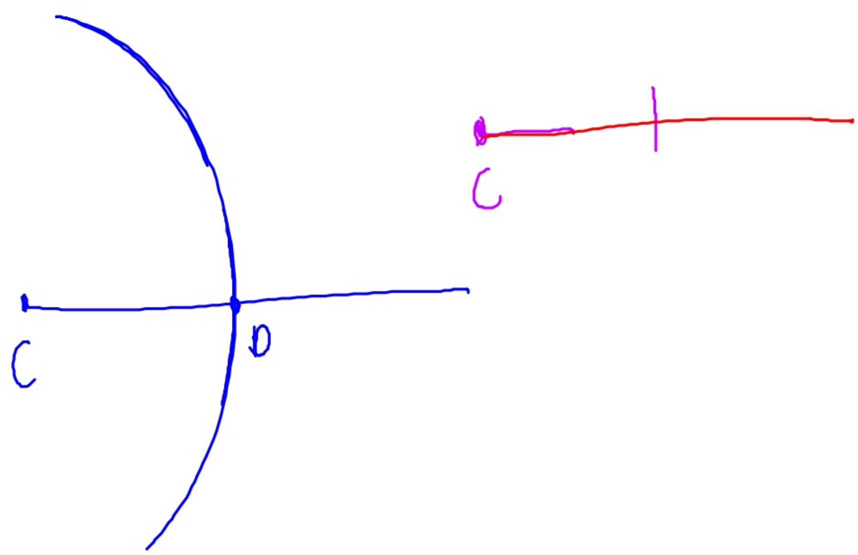
Construct a segment with the same length as $\overline{AB}$.

A In the space below, draw a line segment that is longer than $\overline{AB}$. Choose an endpoint of the segment and label it C.



B Set the opening of your compass to the distance *AB*, as shown.

C Place the point of the compass on *C*. Make a small arc that intersects your line segment. Label the point *D* where the arc intersects the segment. $\overline{CD}$ is the required line segment.



REFLECT

1a. Why does this construction result in a line segment with the same length as $\overline{AB}$?

1b. What must you assume about the compass for this construction to work?

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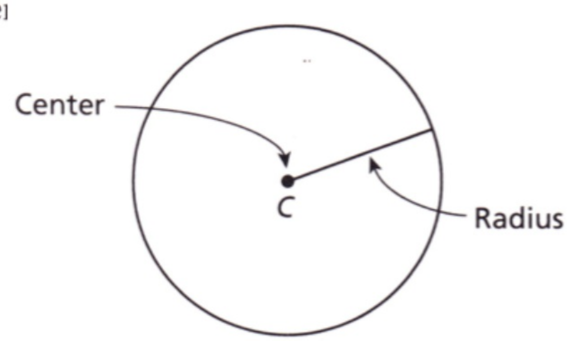
On your paper, draw two segments roughly like those shown.
Use these segments in Exercises 1-4 to construct a segment having the indicated length

1. a + b
2. b - a
3. 3a - b
4. a + 2b

Skip ahead

A **circle** is the set of all points in a plane that are a fixed distance from a point called the **center** of the circle. A **radius** is a line segment whose endpoints are the center of the circle and any point on the circle. The length of such a segment is also called the radius.



Circle C

CC.9–12.G.CO.12

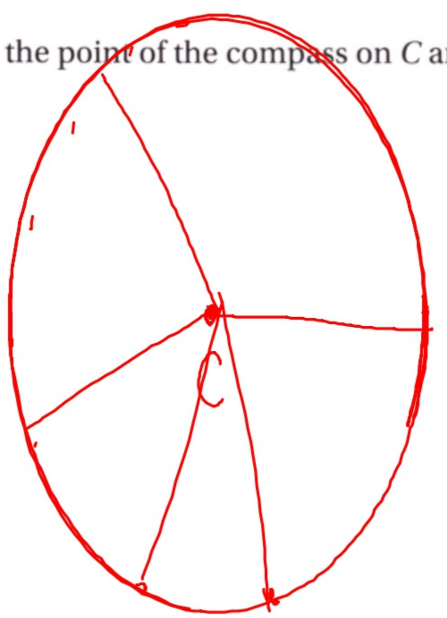
3 EXAMPLE Constructing a Circle

Construct a circle with radius *AB*.

A In the space at right, draw a point and label it *C*. This will be the center of the circle.

B Set the opening of your compass to the distance *AB*.

C Place the point of the compass on *C* and draw a circle.



REFLECT

3a. How could you use a piece of string, a thumbtack, and a pencil to construct a circle with radius *AB*?

Use the figure to construct each figure in the space provided.

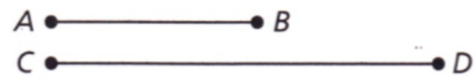
1. a segment with the same length as $\overline{KJ}$

2. a circle with radius *KL*

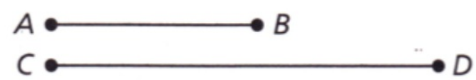
Skip until tomorrow

3. Is it possible to construct the midpoint of a ray? Why or why not?

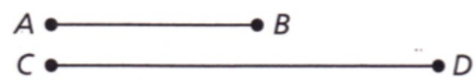
4. Use a compass and straightedge to construct a segment whose length is $AB + CD$.



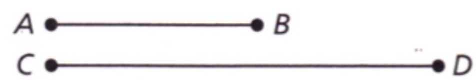
5. Use a compass and straightedge to construct a segment whose length is $CD - AB$.



6. Use a compass and straightedge to construct a triangle that has two sides of length *AB* and one side of length *CD*.



7. Use a compass and straightedge to construct a triangle that has two sides of length *CD* and one side of length *AB*.



Using AB from the previous example, construct a segment whose length is $3 \cdot AB + CD$

For Exercises 1–4, use the segment shown below. Draw your answers in the space provided.

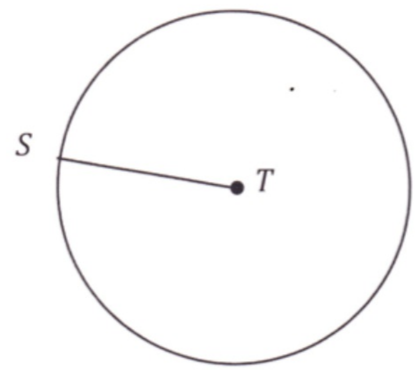
1. Use a compass and straightedge to construct $\overline{XY}$ with the same length as $\overline{UV}$.

2. Use a compass and straightedge to construct a segment whose length is 2 • *UV*.

3. Use a compass and straightedge to construct a triangle with sides of length *UV*.

4. Copy $\overline{UV}$. Then bisect $\overline{UV}$ and label the midpoint M. Construct a circle with center M and radius MU. Construct a second circle with center V and radius MU.

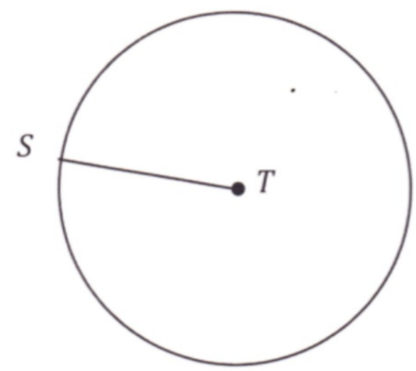
Problem Solving



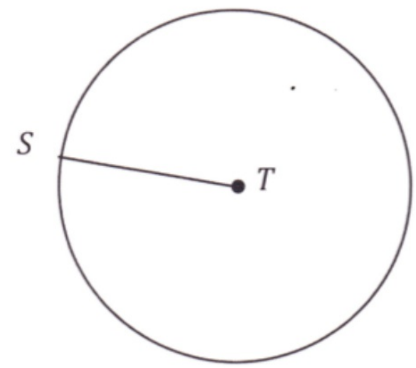
For Exercises 1–3, use the circle shown.

1. Copy the circle.

2. Explain how you can use your construction from Exercise 1 to construct two half circles with radius *ST*. Then construct the two half circles.



3. Construct a segment MN that is the same length as $\overline{ST}$. Then construct a triangle that has exactly two sides with length MN. How does the length of the third side compare with $2 \bullet MN$?



Choose the best answer.

4. Julia drew $\overline{PQ}$ on a piece of paper. She folded the paper so that point P was on top of point Q, forming a crease through $\overline{PQ}$. She labeled the intersection of this crease and $\overline{PQ}$ point S. If $PQ = 2.4$ centimeters, then what is the length of $\overline{QS}$?

   A 0.6 cm
   B 1.2 cm
   C 2.4 cm
   D 4.8 cm

5. Points *J*, *K*, and *L* lie on the same line, and point *K* is between *J* and *L*. Todd constructs $\overline{SV}$ with the same length as $\overline{JL}$. Then he draws point *T* on $\overline{SV}$ so that $\overline{ST}$ is the same length as $\overline{JK}$. Which statement is *not* true?

   F $JK = ST$

   G $ST = SV - TV$

   H $SV = JK + KL$

   J $TV = ST + KL$