Lesson 1.1 – Building Blocks of Geometry

There are three undefined building blocks of geometry. We cannot define these terms because they are ideas that we build other definitions from.

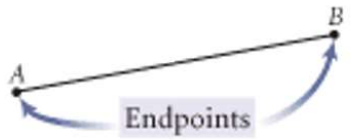
The three undefined building blocks are point, line, and plane.

Point – A point is described as having no length and no width. The mathematical model of a point is a small circle with a capital letter by it. We name points using capital letters (i.e. point P)

Line – A line is described as only having one dimension. It goes forever in both directions. The mathematical model of a line has arrows on both sides of the figure. Lines are named using any two points on the line in either order with a line over the top. (i.e. $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$).

Plane – A plane is described as a two-dimensional surface that continues forever in both directions. The mathematical model of a plane looks like a two-dimensional figure tipped sideways. Planes are named using a single uppercase script letter or three points in the plane (i.e. plane $\mathcal{P}$ or plane DEF).

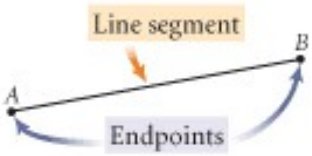
Endpoints – Endpoints are the points at which an object starts or ends.



Collinear – Collinear means on the same line. Points A, B, and C are collinear.

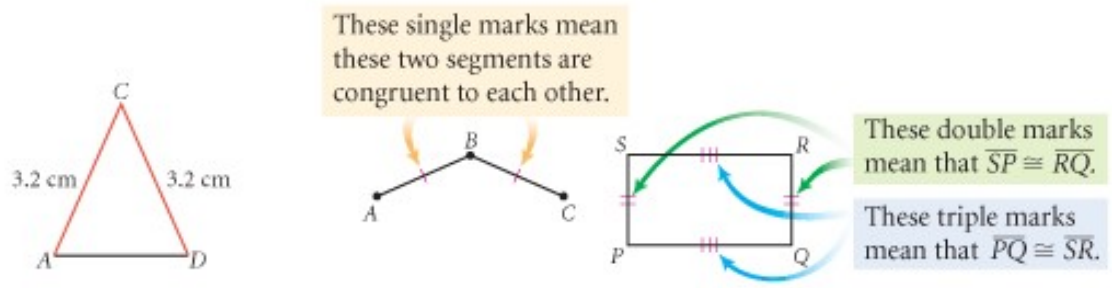
Coplanar – Coplanar means on the same plane. Points D, E, and F are coplanar.

Line Segment - A line segment consists of two endpoints and every point between and collinear to the two endpoints. To name line segments, use the endpoints in either order with a line segment over the top (i.e. $\overline{AB}$ or $\overline{BA}$).

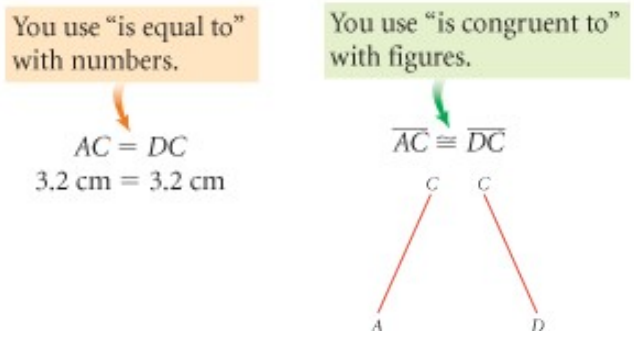


To indicate measure of a line segment remove the line segment over the top of the name or use a lowercase m before the line segment name (i.e. AB or $m\overline{AB}$).

Congruent - Two segments are congruent if and only if they have equal measures or lengths. When drawing figures, you show congruent segments by making identical markings

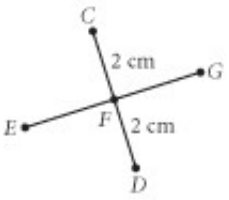


Use equal signs with numbers and congruent signs with figures.

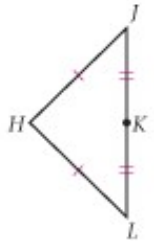


Midpoint (Bisector of a Line Segment) - A midpoint of a line segment is the point that is the same distance from both endpoints. The midpoint of a line segment bisects the line segment, or divides it into two congruent segments.

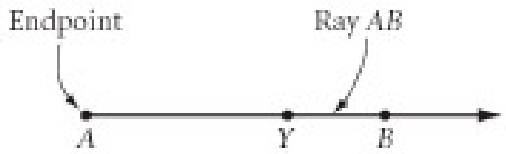
We can say F is the midpoint of $\overline{CD}$ because it is the same distance from C as it is from D.



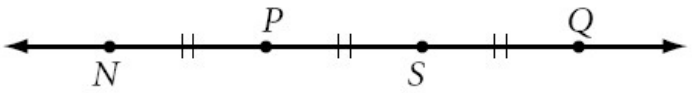
We can say K bisects $\overline{JL}$ because it divides $\overline{JL}$ into $\overline{JK}$ and $\overline{KL}$, and $\overline{JK} \cong \overline{KL}$.



Ray - A line that contains a point and all points in one direction from that endpoint. Rays are named with the endpoint FIRST and any other point on the ray as the second reference point (i.e. $\overrightarrow{AB}$ or $\overrightarrow{AY}$).



Example 1: Complete the statement.



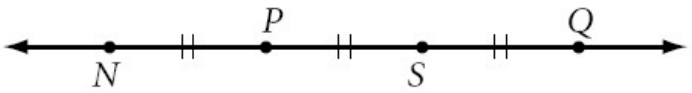
$\overline{PS} = 3$ cm

The midpoint of $\overline{PQ}$ is _____.

Since the midpoint is the middle of the segment from P to Q, we know that this is S. We only know it is S because the length from point P to S is marked congruent to the length from point S to Q.

The midpoint of $\overline{PQ}$ is _____S_____.

Example 2: Complete the statement.



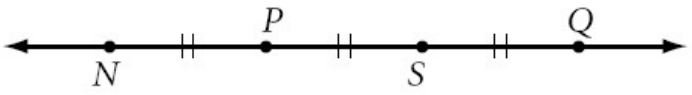
$\overline{PS} = 3$ cm

$NQ =$ _____.

Since the points NQ are do not have a figure marking above them, we know that this means they are asking for the length of the line segment from N to Q. We know that the length from P to S is 3 cm. N to P and S to Q are marked congruent to PS, so we know each of those are also 3 cm. Therefore, the length of the segment $NQ = 3 + 3 + 3 = 9$.

$NQ =$ _____9 cm_____.

Example 3: Complete the statement.



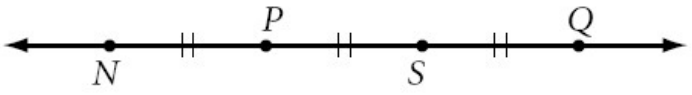
$\overline{PS} = 3$ cm

Another name for $\overline{NS}$ is _____.

Line segments can be named with the endpoints in either order. Since N and S need to be the endpoints, we can say another name is $\overline{SN}$.

Another name for $\overline{NS}$ is _____$\overline{SN}$_____.

Example 4: Complete the statement.



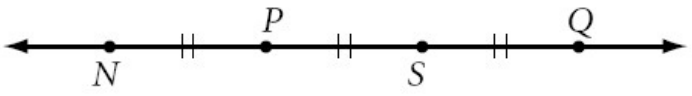
$\overline{PS} = 3$ cm

S is the _____ of $\overrightarrow{SQ}$.

The single arrow over $\overrightarrow{SQ}$ indicates that the figure is a ray. Since S is the first letter of the name of the ray, we know that it is the endpoint.

S is the ___endpoint_____ of $\overrightarrow{SQ}$.

Example 5: Complete the statement.



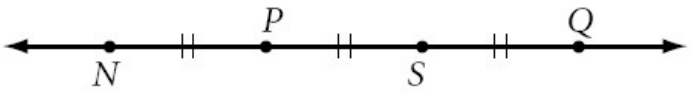
$\overline{PS} = 3$ cm

P is the midpoint of _____.

The midpoint is in the middle of the segment. P is in the middle of N and S. Therefore P is the midpoint of $\overline{NS}$ or $\overline{SN}$.

P is the midpoint of __$\overline{NS}$ or $\overline{SN}$_____.

Example 6: Complete the statement.



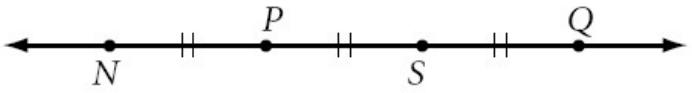
$\overline{PS} = 3$ cm

$\overline{NS} \cong$ _____.

Since the points NS have a line segment over the top and the sign is a congruent sign instead of an equal sign, we know that we are being asked for the name of another line segment that would have the same length as NS. We know that $NS = 6$ cm. The other segment that also has a length of 6 cm is $\overline{PQ}$.

$\overline{NS} \cong$ ___$\overline{PQ}$_____.

Example 7: Complete the statement.



$\overline{PS} = 3$ cm

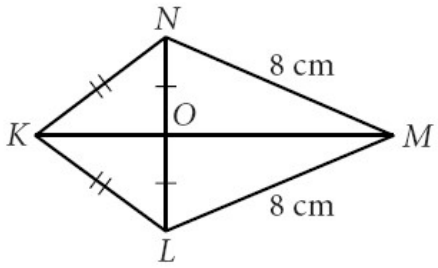
Another name for $\overrightarrow{SN}$ is _____.

The single arrow over $\overrightarrow{SN}$ indicates that the figure is a ray. The first letter in the name of the ray is the endpoint of the ray. Endpoints always have to be first in the name. So, the S must remain the first letter of the name. The second letter indicates which direction the ray goes. So, since N is to the left of S, we are looking for another point to the left of S. The only other point to the left of S is P, so the other name for the ray must be $\overrightarrow{SP}$.

Another name for $\overrightarrow{SN}$ is ___$\overrightarrow{SP}$_____.

Example 8: Complete.

Name all pairs of congruent segments in $KLMN$. Use the congruence symbol to write your answer.



Since $\overline{KN}$ and $\overline{KL}$ are both marked with two tick marks, we can say they are congruent. Since $\overline{NO}$ and $\overline{OL}$ are both marked with one tick mark, we can say they are congruent. Since $\overline{NM}$ and $\overline{LM}$ are the same length, we can say they are congruent.

$$\overline{KN} \cong \overline{KL}, \qquad \overline{NO} \cong \overline{OL}, \qquad \overline{NM} \cong \overline{LM}$$

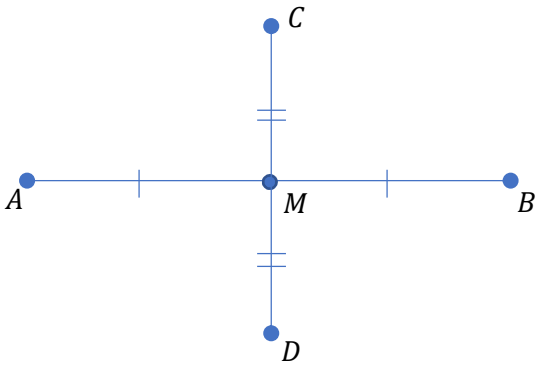
Example 9: Draw and label the figure. Use congruent marks where appropriate.

$\overline{AB}$ and $\overline{CD}$ with M as the midpoint of both $\overline{AB}$ and $\overline{CD}$. $AB = 6.4$ cm and $CD = 4.0$ cm. $A, B,$ and C are not collinear.

Let's start by drawing $\overline{AB}$ with a length of 6.4 cm.

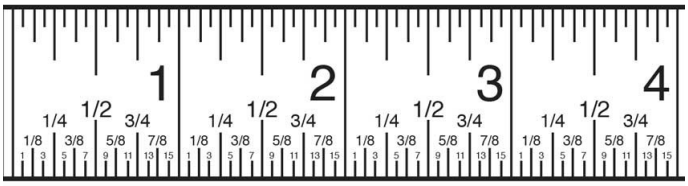
Now, let's make M the midpoint of $\overline{AB}$. We need to make sure we mark M as the midpoint by putting tick marks on either side to indicate both sides are congruent.

We now need to add $\overline{CD}$ to our figure so that M is also the midpoint of $\overline{CD}$. We can do this by making a vertical line through M that is 2.0 cm on each side of M. We need to make sure we mark M as the midpoint by putting tick marks on either side to indicate both sides are congruent.

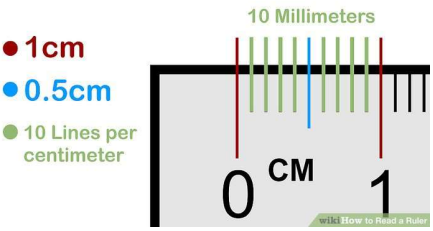


Since $A, B,$ and C are not collinear, we have finished our drawing.

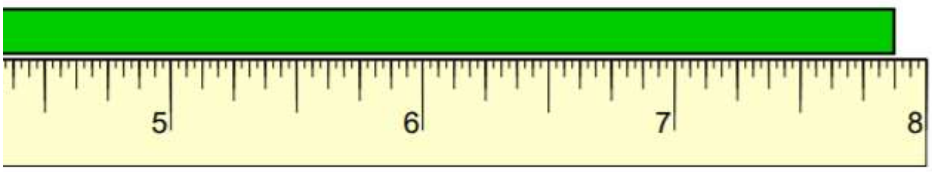
Inches Ruler



Centimeter Ruler

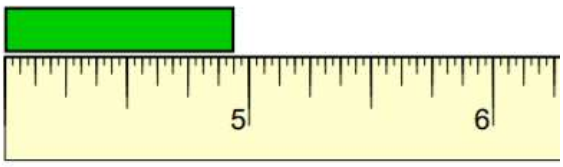


Example #10: Measure the segment in inches. Round your measurement to the nearest $\frac{1}{16}$".



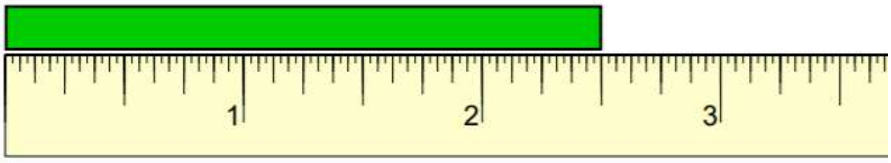
$7\frac{7}{8}$"

Example #11: Measure the segment in inches. Round your measurement to the nearest $\frac{1}{16}$".



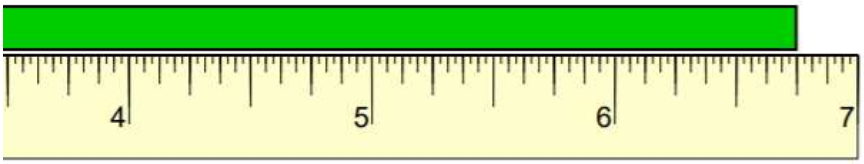
$4\frac{15}{16}$"

Example #12: Measure the segment in inches. Round your measurement to the nearest $\frac{1}{16}$".



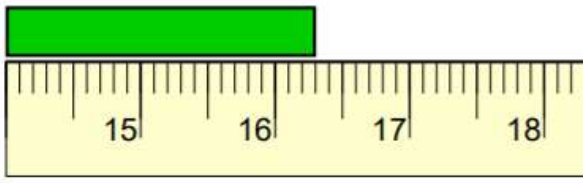
$2\frac{1}{2}$"

Example #13: Measure the segment in inches. Round your measurement to the nearest $\frac{1}{16}$".



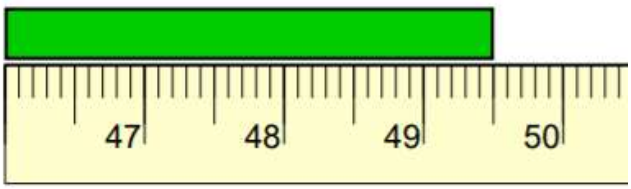
$6\frac{3}{4}$"

Example #14: Measure the segment in centimeters. Round your measurement to the nearest tenth of a centimeter.



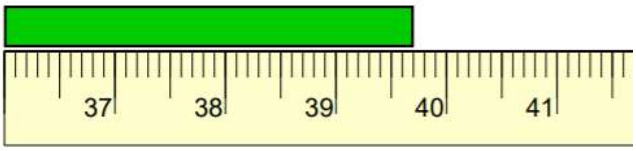
16.3 cm

Example #15: Measure the segment in centimeters. Round your measurement to the nearest tenth of a centimeter.



49.5 cm

Example #16: Measure the segment in centimeters. Round your measurement to the nearest tenth of a centimeter.



39.7 cm