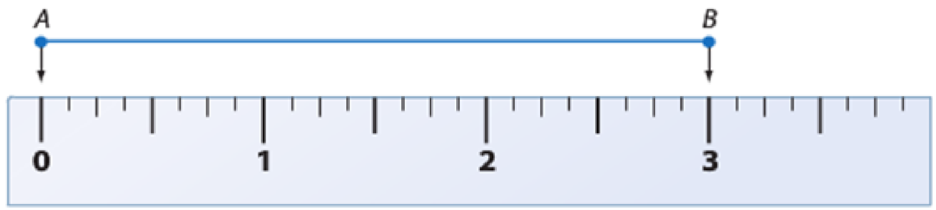
Now, we are going to start proving that certain relationships exist in geometry. We do this in several ways. We can use paragraph proofs to write out our statements and reasons in complete sentences, or we can use a two-column proof to organize our statements and reasons into a table. Either way, we ALWAYS begin a proof with a given statement that we assume is true. From there, we make more assumptions based on previous true information. For every statement we make, we must give a reason for making it (a definition, postulate, theorem, or property). Finally, once we have successfully proven that a certain relationship exists, we end the proof with a statement saying that this relationship exists. "prove" statement

In this section, we will be proving segment relationships. To do this, we must remember a couple of postulates that we have seen previously:

Postulate 2.8 Ruler Postulate

Words The points on any line or line segment can be put into one-to-one correspondence with real numbers.

Symbols Given any two points *A* and *B* on a line, if *A* corresponds to zero, then *B* corresponds to a positive real number. → a segment can be measured.

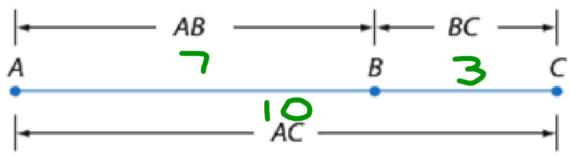


Postulate 2.9 **Segment Addition Postulate**

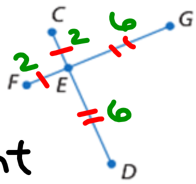
→ on the same line

Words If A, B, and C are collinear, then point B is between A and C if and only if $AB + BC = AC$.

Symbols



Example 1: Prove that if $\overline{CE} \cong \overline{FE}$ and $\overline{ED} \cong \overline{EG}$, then $\overline{CD} \cong \overline{FG}$.



1st → **Given:** $\overline{CE} \cong \overline{FE}$; $\overline{ED} \cong \overline{EG}$ ← TRUE

Prove: $\overline{CD} \cong \overline{FG}$ ← last statement

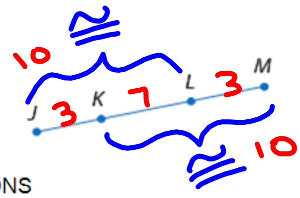
STATEMENTS	REASONS
1. $\overline{CE} \cong \overline{FE}$, $\overline{ED} \cong \overline{EG}$	1. Given
2. CE = FE, ED = EG	2. Def. of congruence
3. CE + ED = CD	3. Segment Addition Post.
4. FE + EG = CD	4. Substitution (steps 2 and 3)
5. FE + EG = FG	5. Segment Addition Post.
6. CD = FG	6. Substitution (steps 4 and 5)
7. $\overline{CD} \cong \overline{FG}$	7. Def. of congruence

def. of congruence: If two objects are identical, then they have the same measure AND if two objects have the same measure, then they are identical.

Example 2:

Given: $\overline{JL} \cong \overline{KM}$

Prove: $\overline{JK} \cong \overline{LM}$



STATEMENTS	REASONS
1. $\overline{JL} \cong \overline{KM}$	1. Given
2. JL = KM	2. Def. of congruence
3. JK + KL = JL KL + LM = KM	3. Segment Addition Postulate
4. JK + KL = KL + LM	4. Substitution (steps 2 and 3)
4.5	
5. JK + KL – KL = KL + LM – KL	5. Subtraction Property of Equality
6. JK = LM	6. Substitution
7. $\overline{JK} \cong \overline{LM}$	7. Definition of Congruence
4.5. KL = KL	4.5. Reflexive Prop.

VocabularyLink

Symmetric

Everyday Use balanced or proportional

Math Use If $a = b$, then $b = a$.

Theorem 2.2 Properties of Segment Congruence / Equality

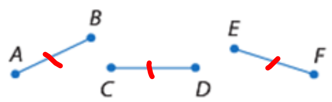
Reflexive Property of Congruence	$\overline{AB} \cong \overline{AB}$ → $AB = AB$	an object is $\cong$ to itself.
Symmetric Property of Congruence	If $\overline{AB} \cong \overline{CD}$, then $\overline{CD} \cong \overline{AB}$. If $AB = CD$, then $CD = AB$	similar to the commutative prop.
Transitive Property of Congruence	If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$. If $AB = CD$ and $CD = EF$, then $AB = EF$.	"leap frog"

If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$.

Example 3: *mark up your pic"

Given: $\overline{AB} \cong \overline{CD}$; $\overline{CD} \cong \overline{EF}$ ← True

Prove: $\overline{AB} \cong \overline{EF}$



STATEMENTS	REASONS
1. $\overline{AB} \cong \overline{CD}$, $\overline{CD} \cong \overline{EF}$	1. Given
2. AB = CD, CD = EF	2. Def. of congruence
3. AB = EF	3. Transititive Prop. (step 2)
4. $\overline{AB} \cong \overline{EF}$	4. Def. of congruence

Example 4:

VOLUNTEERING The route for a charity fitness run is shown. Checkpoints X and Z are the midpoints between the starting line and Checkpoint Y and Checkpoint Y and the finish line F, respectively. If Checkpoint Y is the same distance from Checkpoints X and Z, prove that the route from Checkpoint Z to the finish line is congruent to the route from the starting line to Checkpoint X.

mark up the pic

$\overline{SX} \cong \overline{XY}$ or $SX = XY$

$\overline{YZ} \cong \overline{ZF}$ or $YZ = ZF$

Given: X is the midpoint of $\overline{SY}$. Z is the midpoint of $\overline{YF}$. $XY = YZ$

Prove: $\overline{ZF} \cong \overline{SX}$

Def. of midpoint: the point that divides a line segment into 2 congruent parts.

STATEMENTS	REASONS
1. X is the midpoint of $\overline{SY}$. Z is the midpoint of $\overline{YF}$. XY = YZ	1. Given
2. $\overline{SX} \cong \overline{XY}$, $\overline{YZ} \cong \overline{ZF}$	2. Def. of midpoint
3. $\overline{XY} \cong \overline{YZ}$	3. Def. of congruence
4. $\overline{SX} \cong \overline{YZ}$ ($\overline{SX} \cong \overline{XY}$, $\overline{XY} \cong \overline{YZ}$)	4. Transitive Prop. (Steps 2,3)
5. $\overline{SX} \cong \overline{ZF}$ ($\overline{SX} \cong \overline{YZ}$, $\overline{YZ} \cong \overline{ZF}$)	5. Transitive Prop. (Steps 4,2)
6. $\overline{ZF} \cong \overline{SX}$	6. Symmetric Prop. (Step. 5)