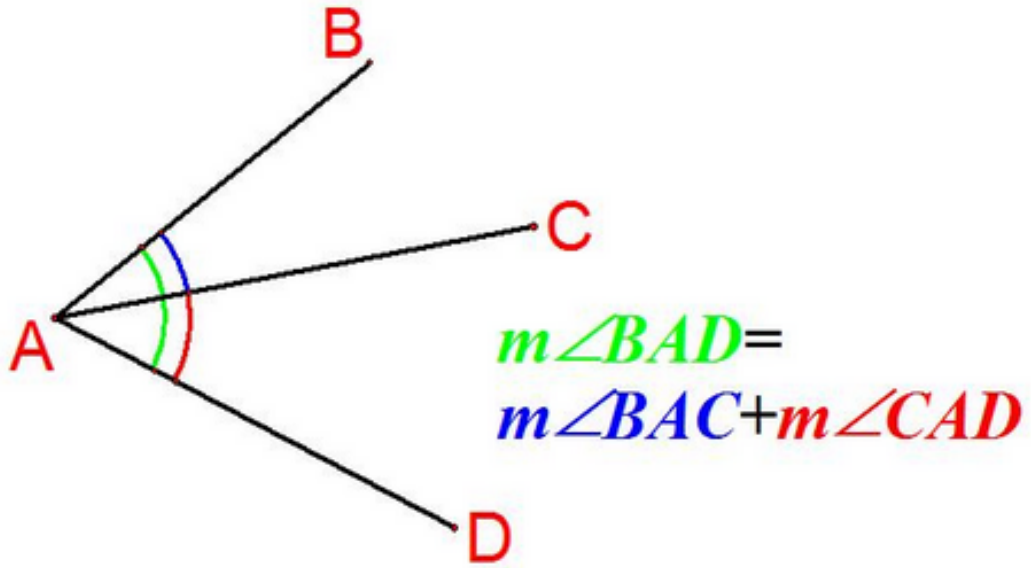
Proving Inequalities in a Triangle

Jonathan R. Bacolod

Sauyo High School

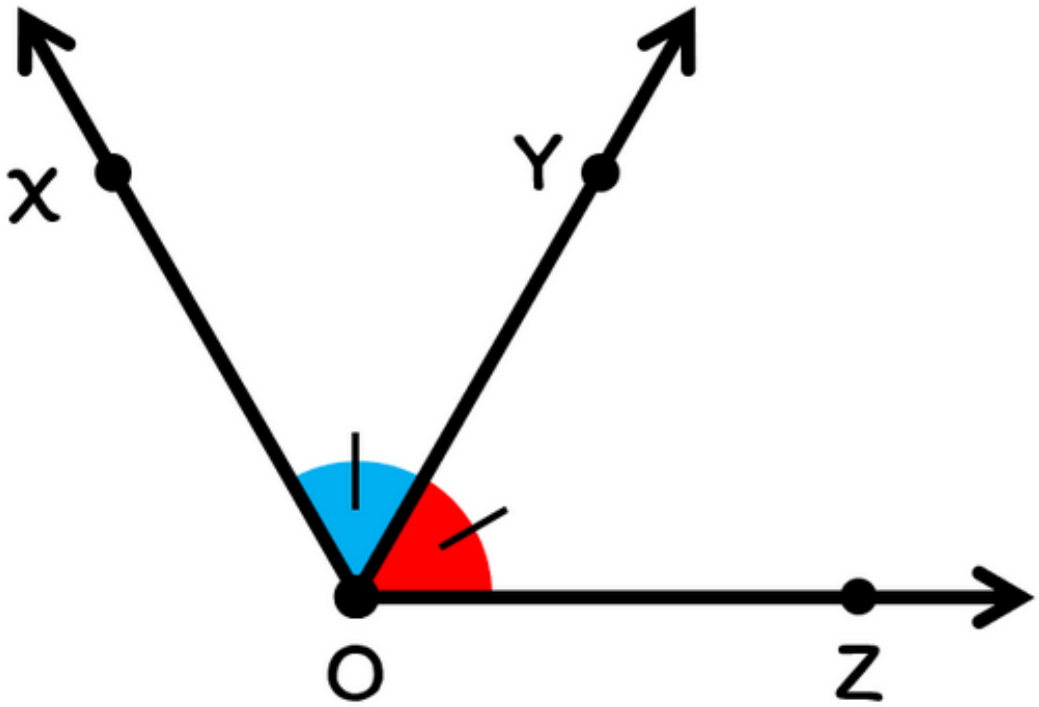
Definitions, Postulates, and Theorems

Angle Addition Postulate



Definitions, Postulates, and Theorems

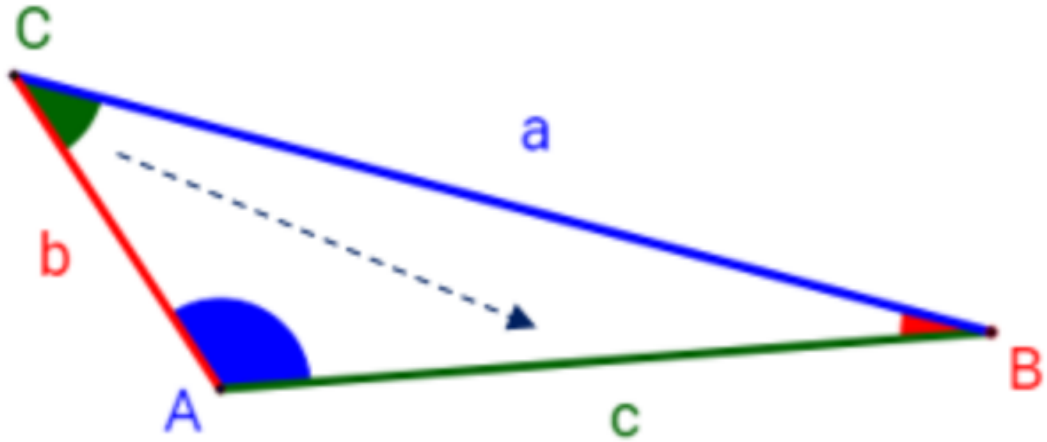
Definition of Angle Bisector



If $\overrightarrow{OY}$ bisects $\angle XOZ$, then $\angle XOY \cong \angle YOZ$.

Definitions, Postulates, and Theorems

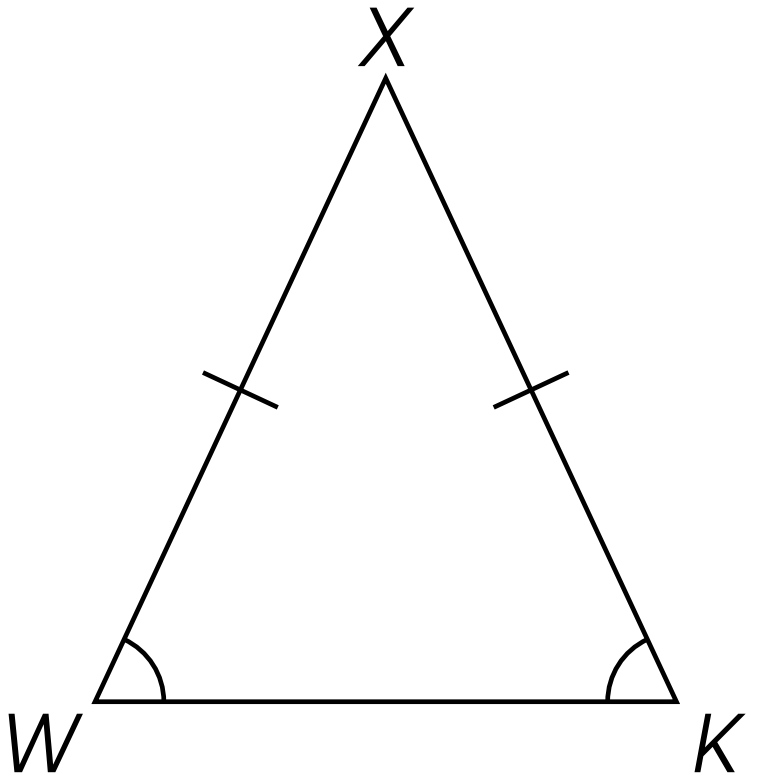
Angle-Side Relationship theorem



In a triangle, the side opposite the larger angle is the longer side.

Definitions, Postulates, and Theorems

Base Angles theorem



If $\overline{XW} \cong \overline{XK}$, then $\angle W \cong \angle K$.

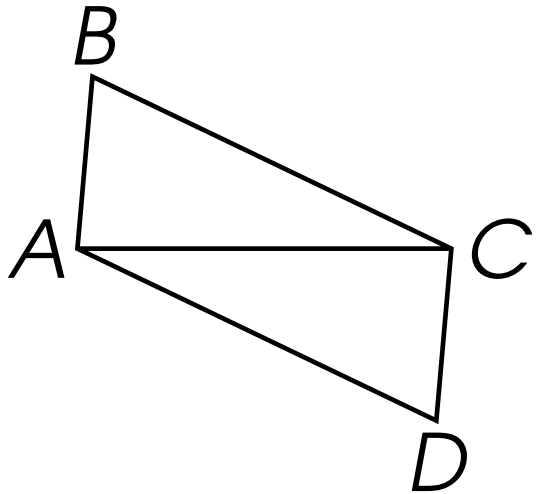
Definitions, Postulates, and Theorems

Definition of Betweenness

If Y is between $\overline{XZ}$, then $m\overline{XZ} = m\overline{XY} + m\overline{YZ}$.

Definitions, Postulates, and Theorems

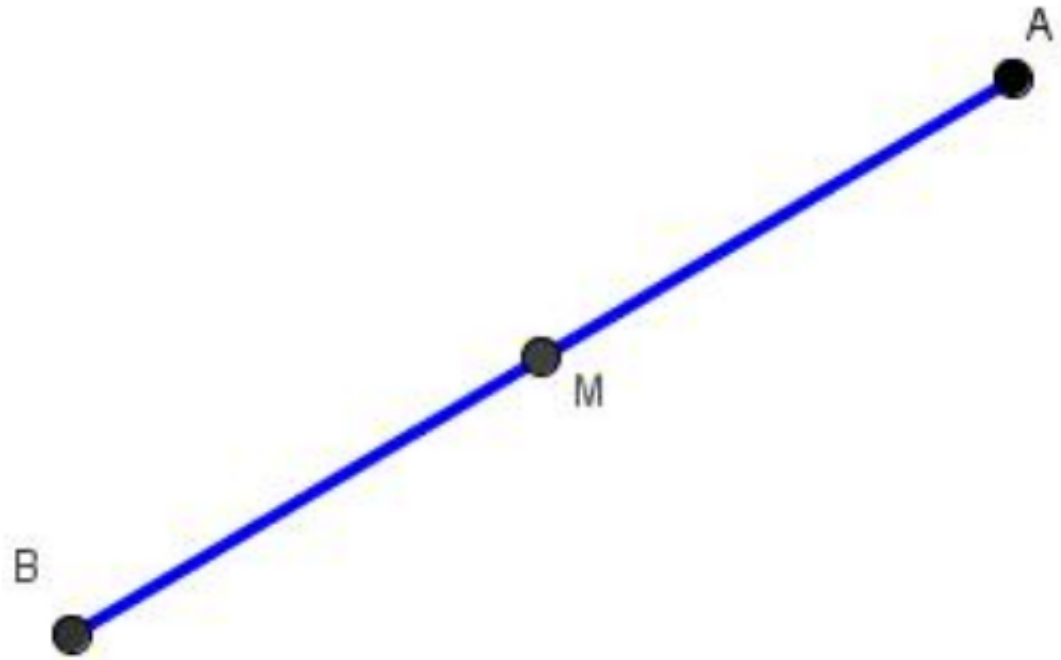
Corresponding Parts of Congruent Triangles are Congruent (CPCTC)



If $\triangle ABC \cong \triangle CDA$, then all the corresponding sides and angles of the triangles are congruent.

Definitions, Postulates, and Theorems

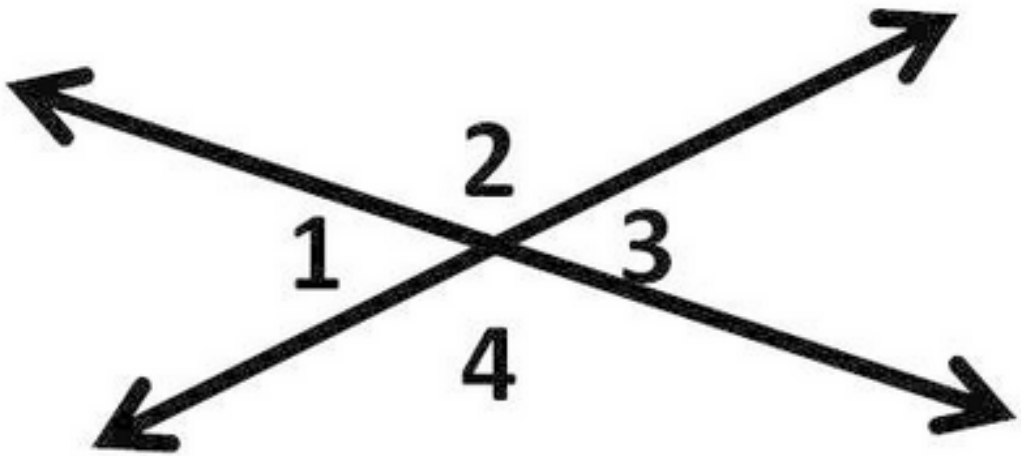
Definition of Midpoint



If M is the midpoint of $\overline{BA}$, then $\overline{BM} \cong \overline{MA}$.

Definitions, Postulates, and Theorems

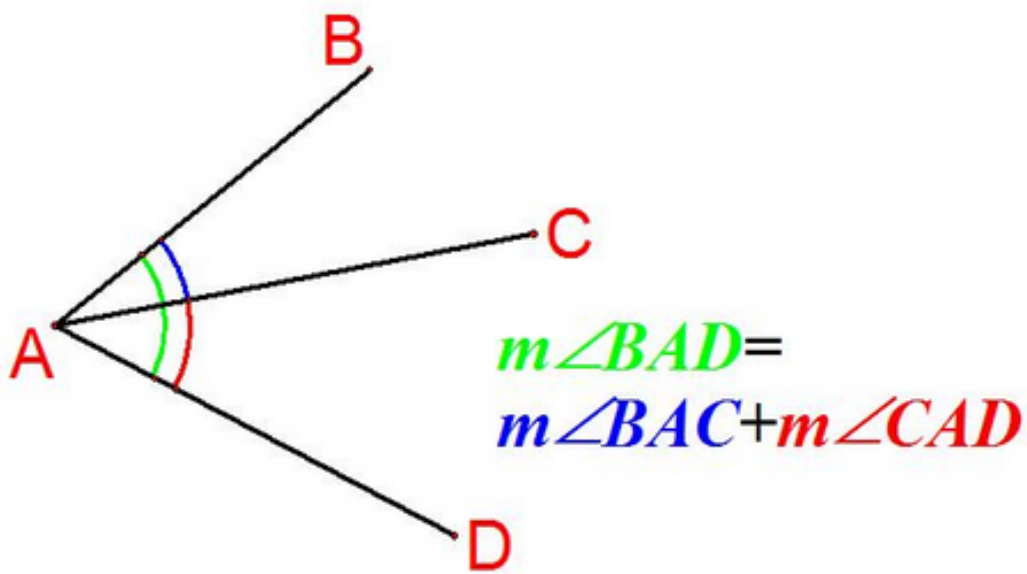
Vertical Angles theorem



If $\angle 1$ and $\angle 3$ are vertical angles, then $\angle 1 \cong \angle 3$.

Definitions, Postulates, and Theorems

The whole is greater than its parts.

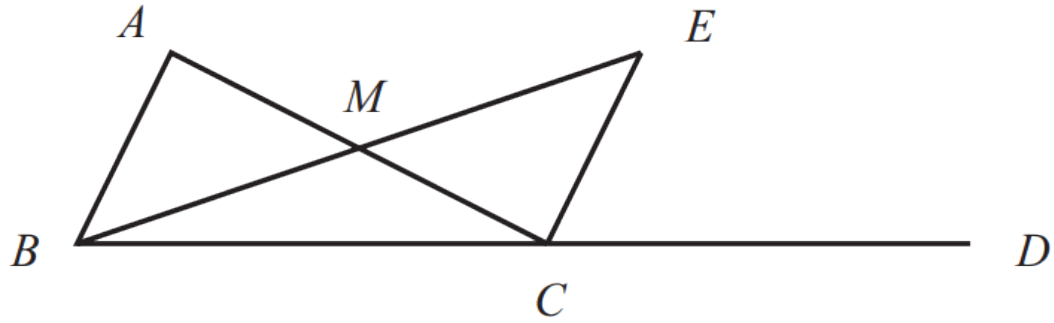


$m\angle BAD > m\angle BAC$ and $m\angle BAD > m\angle CAD$.

Exterior Angle Inequality Theorem

Given: M is the midpoint of $\overline{AC}$ and $\overline{BE}$

Prove: $m\angle ACD > m\angle A$



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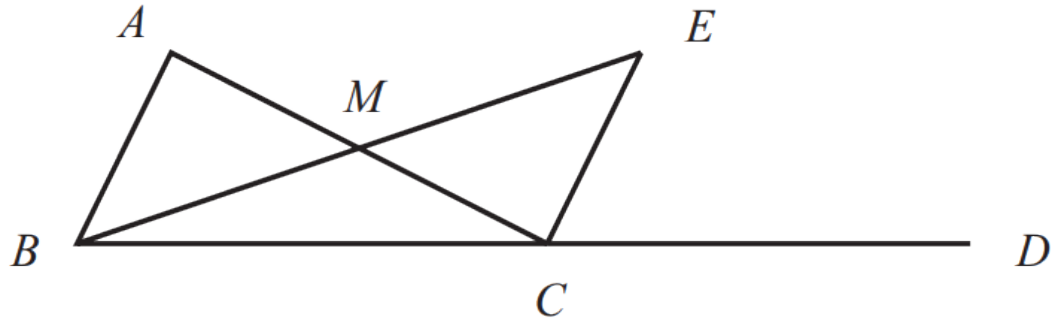

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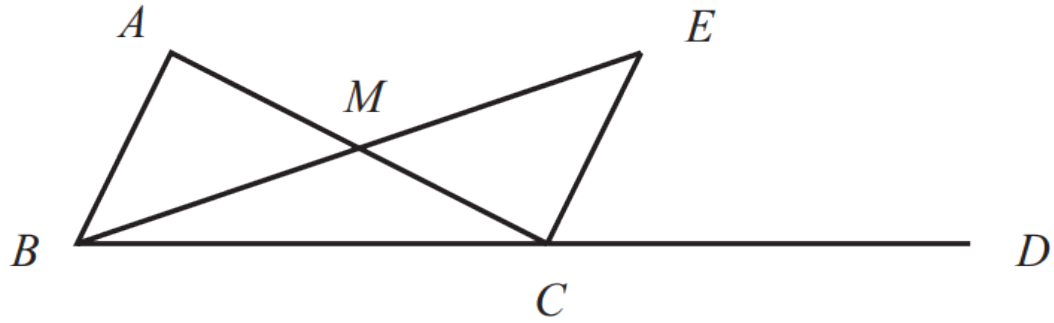

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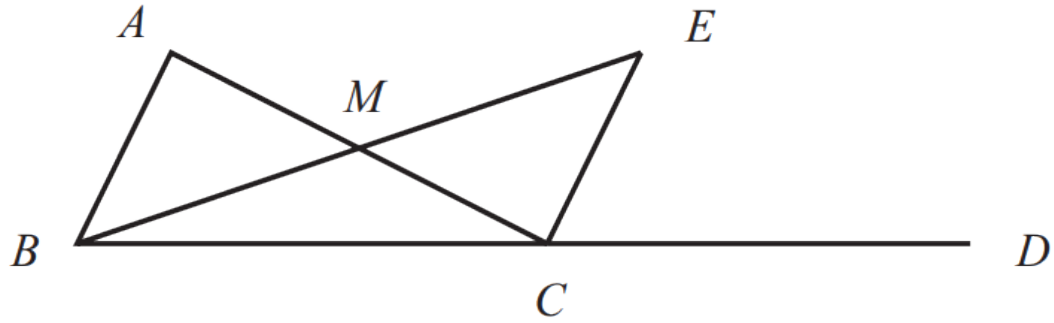

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2. $\overline{AM} \cong \overline{CM}, \overline{BM} \cong \overline{EM}$	2. Definition of Midpoint

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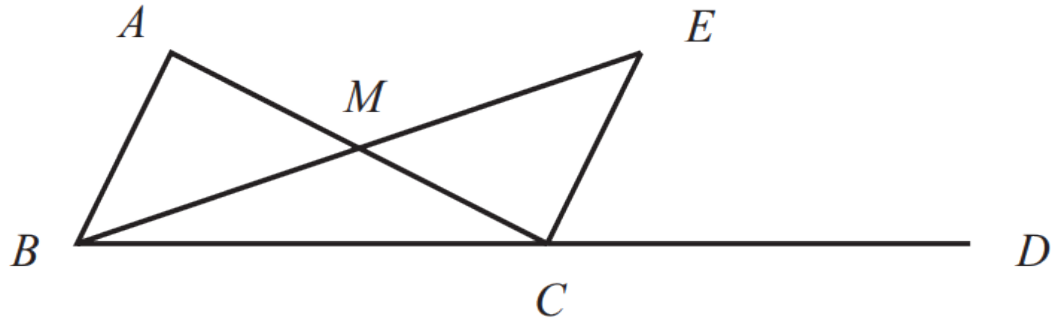

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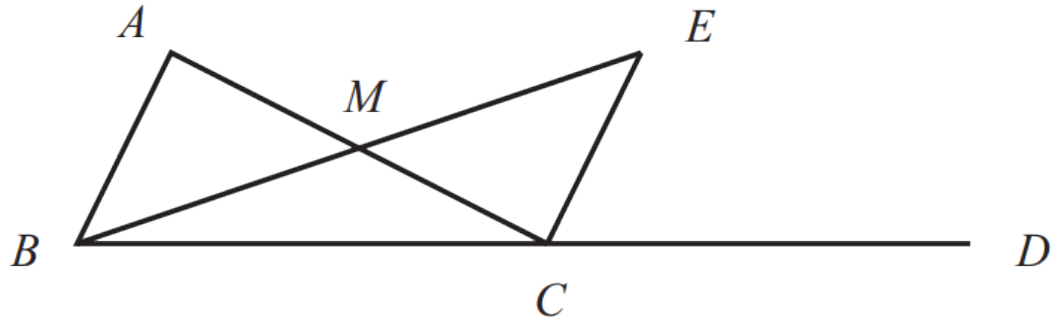

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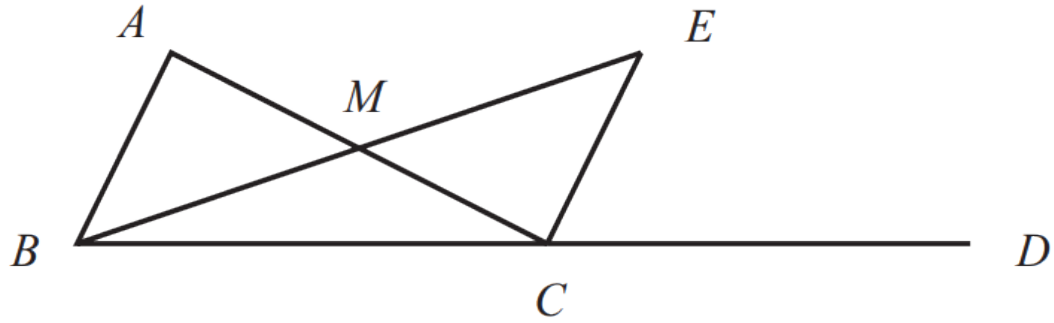

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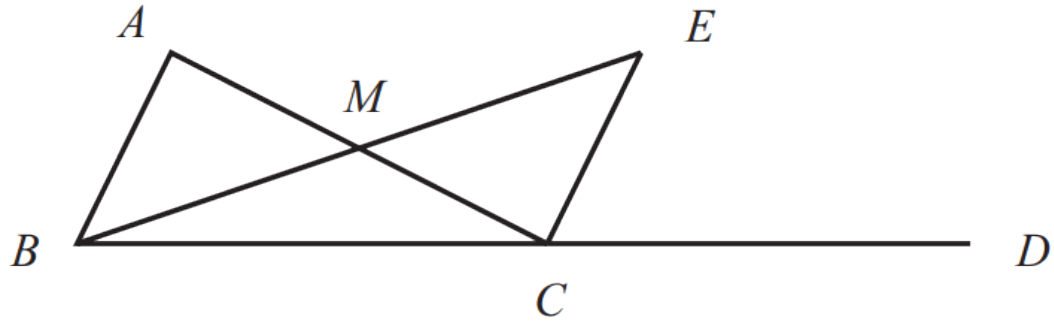

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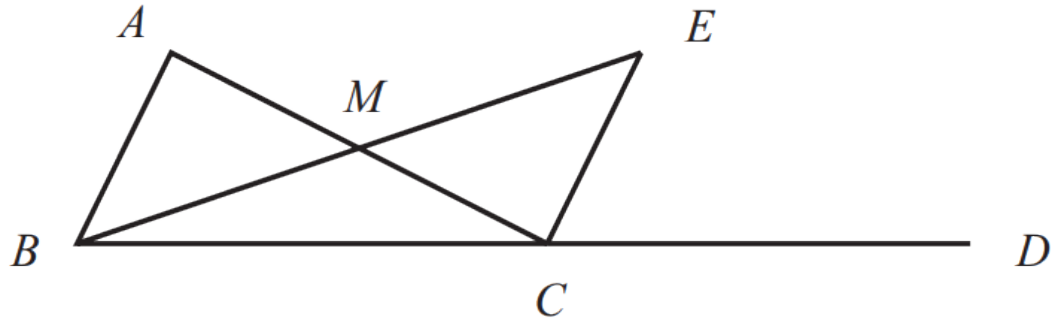

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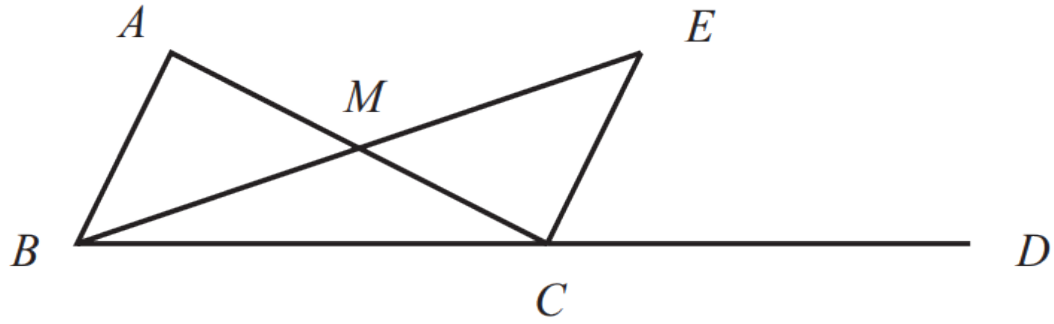

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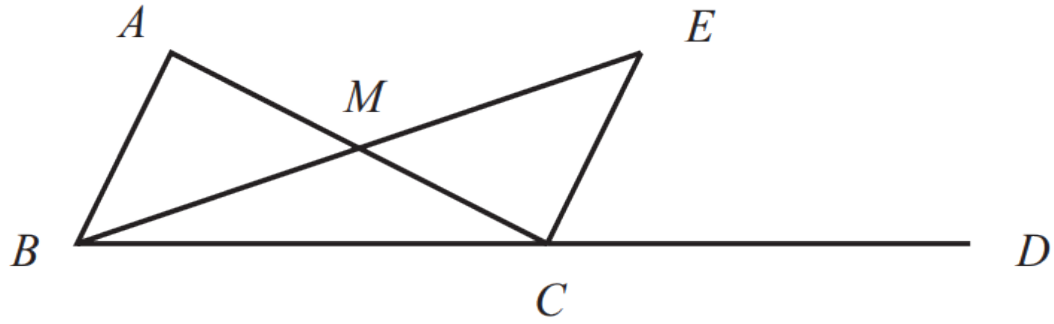

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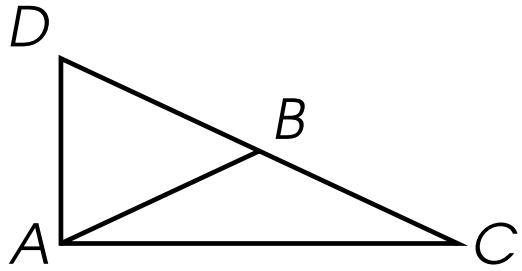
Triangle Inequality Theorem

Given: B is the midpoint of $\overline{CD}$

$\overline{AB} \cong \overline{BC}$

Prove: $m\overline{AB} + m\overline{BC} > m\overline{AC}$



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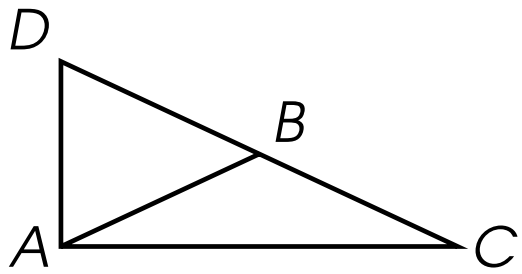

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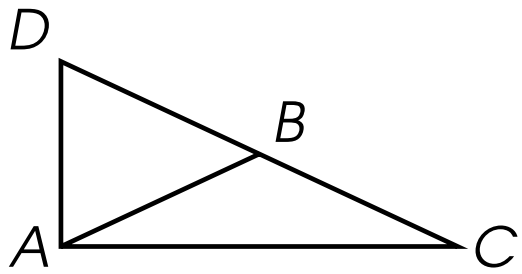

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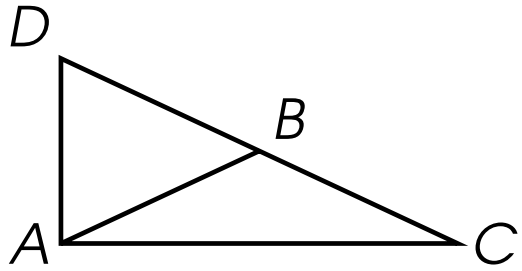

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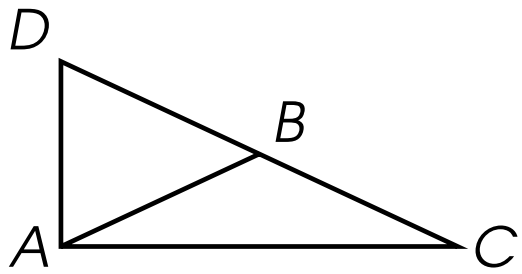

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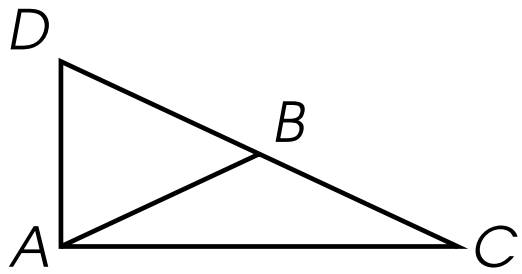

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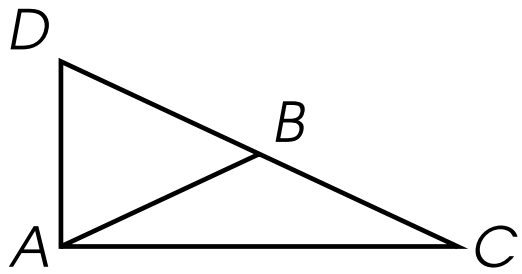

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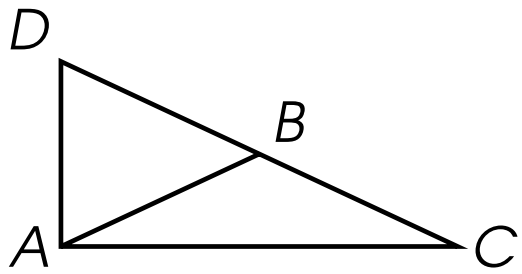

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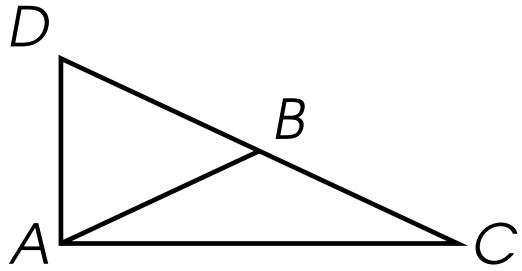

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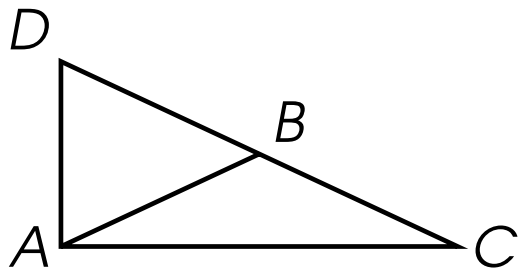

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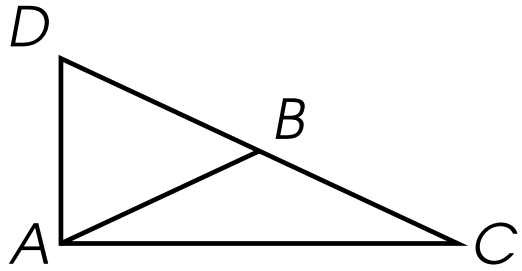

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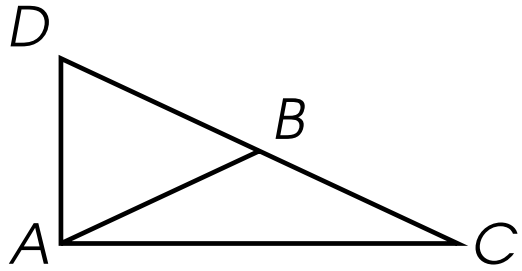
Proof:



Statements	Reasons
1. $\overline{AB} \cong \overline{BC}$, B is the midpoint of $\overline{CD}$ and $\overline{BE}$	1. Given
2. $\overline{BC} \cong \overline{DB}$	2. Definition of Midpoint
3. $\overline{AB} \cong \overline{DB}$	3. Transitive Property
4. $\angle D \cong \angle DAB$	4. Base Angles Theorem
5. $m\angle DAC = m\angle DAB + m\angle BAC$	5. Angle Addition Postulate
6. $m\angle DAC = m\angle D + m\angle BAC$	6. Substitution Property
7. $m\angle DAC > m\angle D$	7. The whole $>$ its parts.
8. $m\overline{DC} > m\overline{AC}$	8. Angle-Side Relationship theorem
9. $m\overline{DC} = m\overline{DB} + m\overline{BC}$	9. Def. of Betweenness
10. $m\overline{DC} = m\overline{AB} + m\overline{BC}$	10. Substitution Property

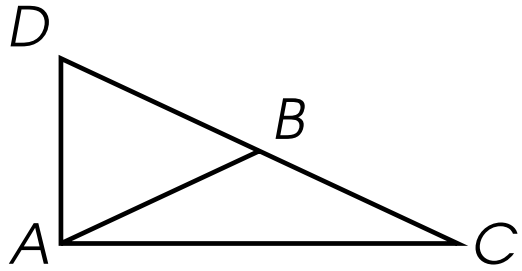
Triangle Inequality Theorem

Given: B is the midpoint of $\overline{CD}$

$\overline{AB} \cong \overline{BC}$

Prove: $m\overline{AB} + m\overline{BC} > m\overline{AC}$

Proof:



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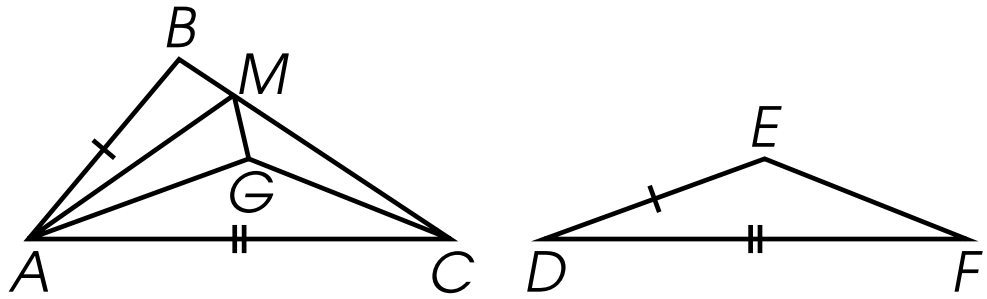
Hinge Theorem

Given: $\overline{AM}$ bisects $\angle BAG$

$\overline{AB} \cong \overline{DE}, \overline{AC} \cong \overline{DF}$

$\triangle AGC \cong \triangle DEF$

Prove: $m\overline{BC} > m\overline{EF}$



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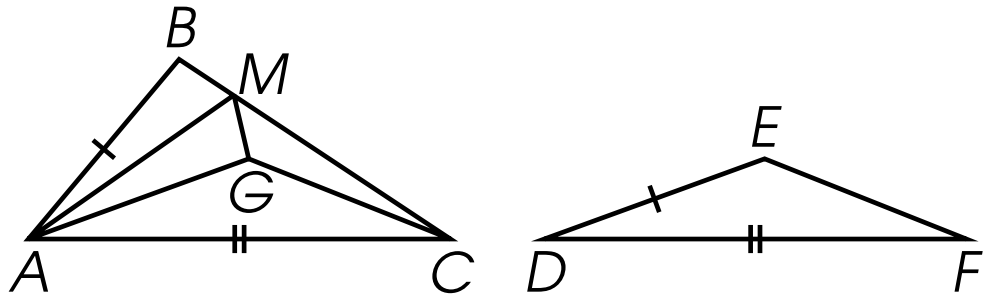

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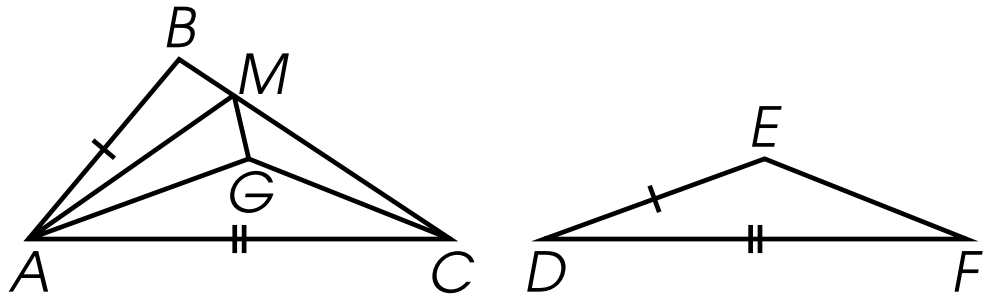

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Hinge Theorem

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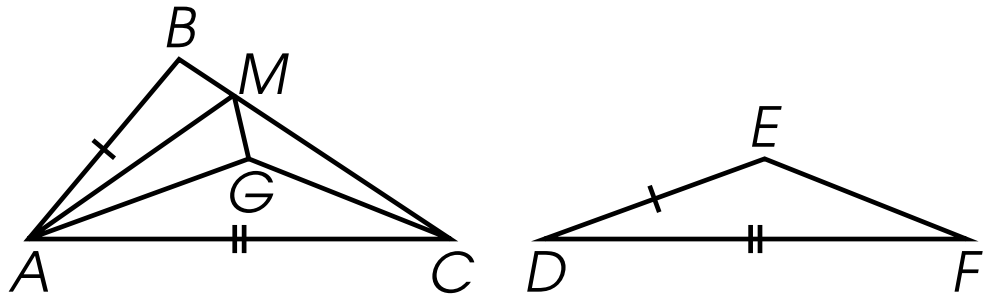

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1. $\triangle AGC \cong \triangle DEF$	1. Given
2. $\overline{AG} \cong \overline{DE}, \overline{GC} \cong \overline{EF}$	2. CPCTC

Hinge Theorem

Given: $\overline{AM}$ bisects $\angle BAG$
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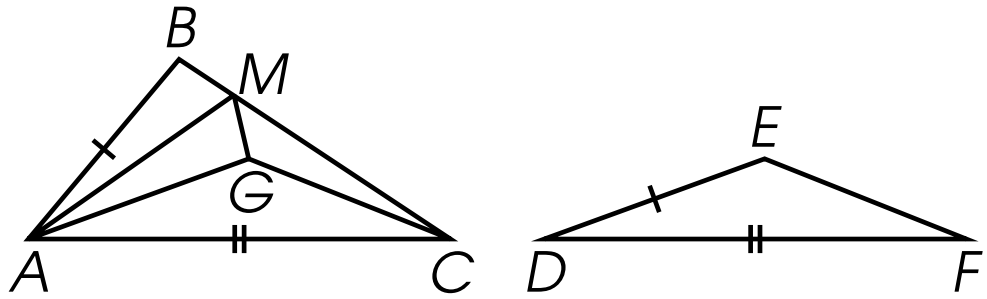

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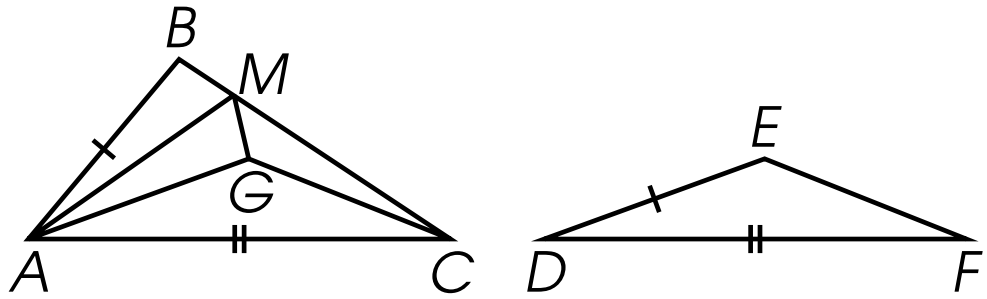

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Hinge Theorem

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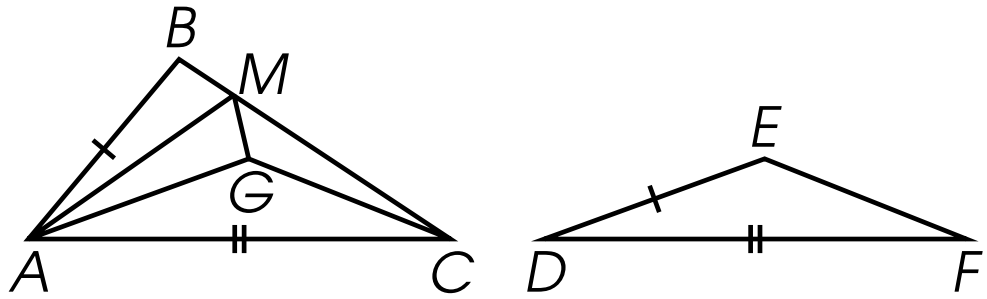

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5. $\triangle BAM \cong \triangle GAM$	5. SAS Postulate

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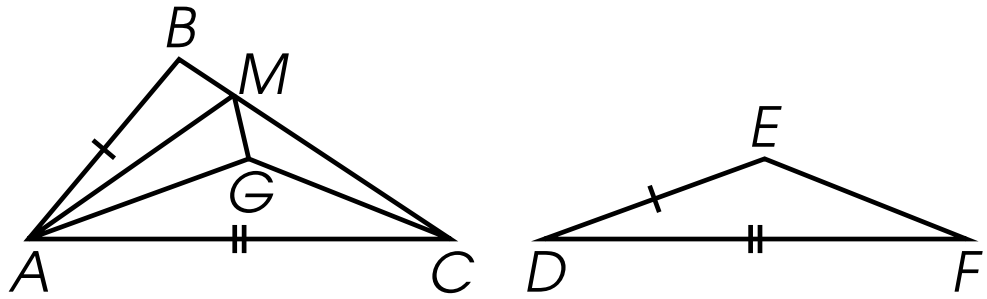

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6. $\overline{BM} \cong \overline{GM}$	6. CPCTC

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Given: $\overline{AM}$ bisects $\angle BAG$
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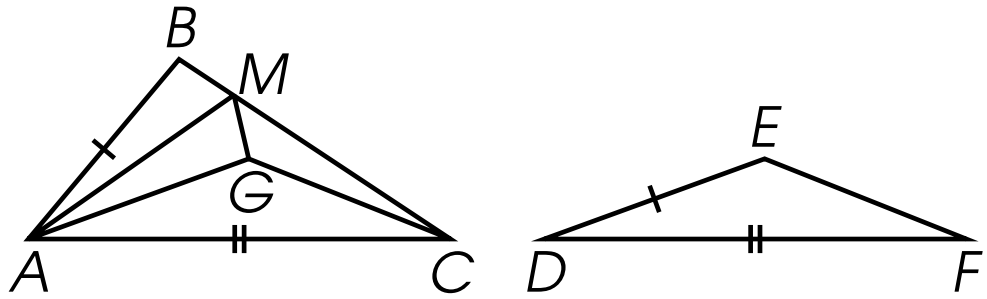

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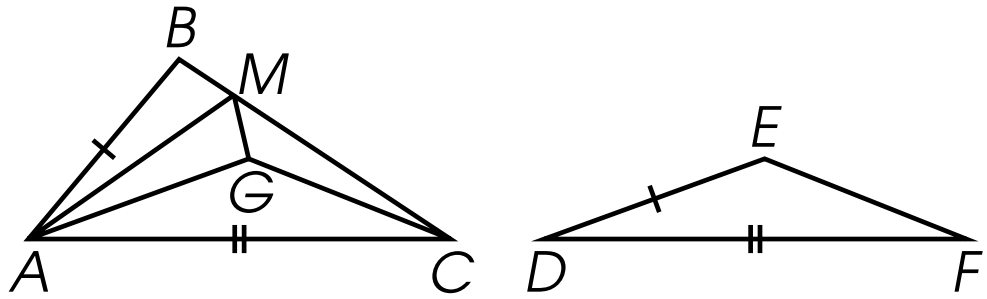

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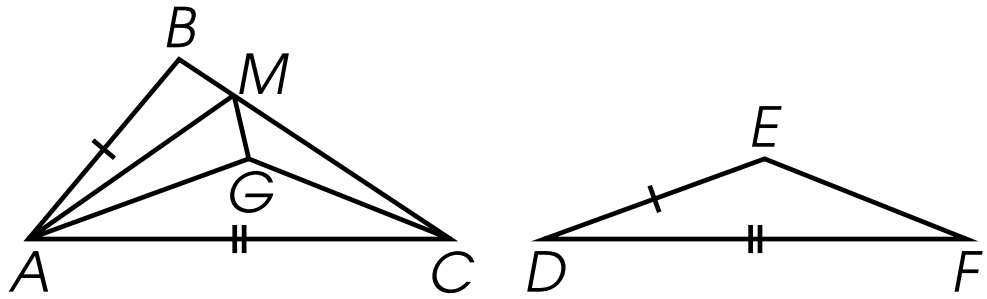

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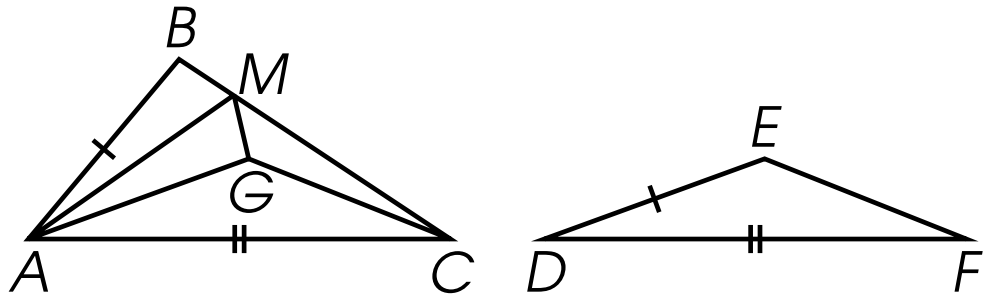

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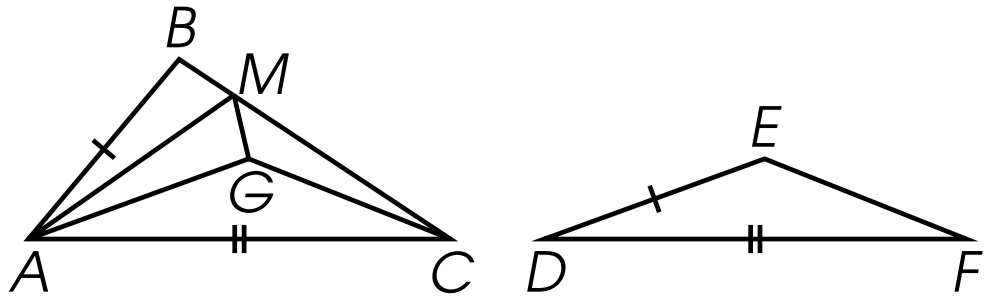

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Thank you for attending the virtual class.