5.3 Notes-Indirect Proof

Indirect proof- A way to prove a statement true by assuming its conclusion is false and showing that this assumption leads to a contradiction of the given, definition, theorem or postulate known to be true.

Steps for writing an indirect proof:

1. Assume the conjecture is false aka "opposite"
2. Show work or write explanations which lead to a Contradiction of the given info, theorem, definition, or postulate.
3. State that the assumption must be false and the original conjecture Conclusion must be true.

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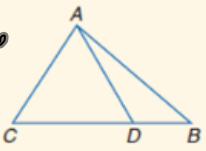
Example 1

Write an indirect proof.

Given: $m\angle ADC \neq m\angle ADB$

Prove: $\overline{AD}$ is not an altitude of $\triangle ABC$.

Conjecture



Step1: Assume $\overline{AD}$ is an altitude of $\triangle ABC$.

Step2: By def of altitude, $\overline{AD} \perp \overline{BC}$.
By def of $\perp$, $\angle ADC = 90$ & $\angle ADB = 90$
Using subsitution, $\angle ADC = \angle ADB$.
Which contradicts the given.

Step3: Our assumption that $\overline{AD}$ is an altitude is false, so $\overline{AD}$ is not an altitude of $\triangle ABC$.

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Example 2

Write an indirect proof.

Given: ΔABC

Prove: A triangle can contain only one obtuse angle.

Step 1: Assume a Δ can contain more than 1 obtuse $\angle$.

Step 2: By def of obtuse $\angle$, then $\angle A > 90^\circ$ and $\angle B > 90^\circ$. So $\angle A + \angle B + \angle C > 180^\circ$ which contradicts the Δ Sum theorem.

Step 3: Our assumption that a Δ can have more than 1 obtuse $\angle$ is false, so A Δ can have only one obtuse $\angle$.

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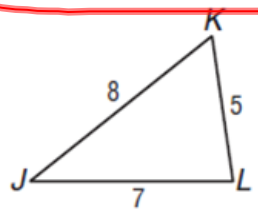
Example 3

Write an indirect proof.

Given: ΔJKL with side lengths 5, 7, and 8 as shown

Prove: $m\angle K < m\angle L$



Step 1: Assume $\angle K \geq \angle L$.

Step 2: $JL \geq JK$ from the Side-angle theorem, which contradicts the given Δ.

Step 3: Our assumption $\angle K \geq \angle L$ is false, so $\angle K < \angle L$.

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