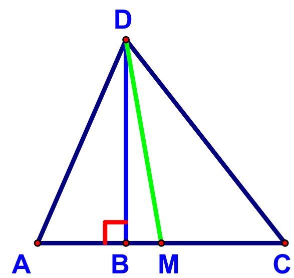
Indirect Proof - Lesson 5-1

Here's the warmup…see if you can "logic out" how to do this…you don't need to do it in a formal 2-column proof – just write out your thoughts!

Given: $\overline{DB} \perp \overline{AC}$
M is the midpoint of $\overline{AC}$

Prove: $\overline{AD}$ is not $\cong$ to $\overline{CD}$

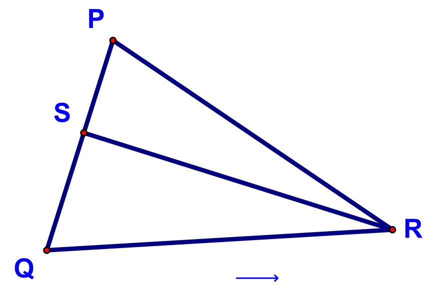


Please do this in paragraph proof form!!

Today, we're going to learn how to do the formal structure of indirect proof. Let's start with the following example, which shows how we should always start an indirect proof by **assuming the opposite of what we're trying to prove**. We'll then use this, in addition to some given information, to try to contradict one of the givens. If we can do that, then we know our assumption was erroneous, and that the opposite of our assumption (the thing we're trying to prove) is true!

Given: $\overline{RS} \perp \overline{PQ}$
$\overline{PR}$ is not $\cong$ to $\overline{QR}$

Prove: $\overrightarrow{RS}$ does not bisect $\angle PRQ$



Either $\overrightarrow{RS}$ bisects $\angle PRQ$ or $\overrightarrow{RS}$ does not bisect $\angle PRQ$, so assume $\overrightarrow{RS}$ bisects $\angle PRQ$.

Statements	Reasons

Note again, that we started by looking at the "Prove" statement and assumed the opposite of it. That is the key to doing indirect proofs. Start with the opposite of what you're trying to prove and try to contradict one of the other givens. We can state the procedure as shown below:

Indirect-Proof Procedure

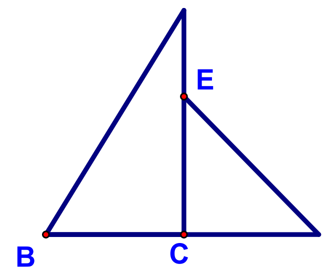
1. **Assume that the negation of the desired conclusion is correct.**
2. **Write a chain of reasons until you reach an impossibility. This will be a contradiction of either**
   a) given information or
   b) a theorem, definition, or other known fact.
3. **State the remaining possibility as the desired conclusion.**

Let’s try the following example to solidify how to do this type of proof. The concluding "paragraph" should always say

> "*Statement x contradicts statement y. Consequently, the assumption must be incorrect. Therefore, [Prove statement goes here]!*"

Given: $\overline{AC} \perp \overline{BD}$
$\overline{BC} \cong \overline{EC}$
$\overline{AB}$ is not $\cong$ to $\overline{ED}$

Prove: $\angle B$ is not $\cong$ to $\angle CED$



Statements	Reasons

Given some of the really hard detour proofs we've been doing, this really isn't that bad. Just make sure to get the procedure down and indirect proofs should be relatively straight forward.