

Name:

Date:

Period: 5

Indirect Proofs

Lesson Objective INBAT write indirect proofs

Suppose you are babysitting your neighbor's child, Billy, and their dog one afternoon after school. While you are watching Toy Story (aka the best Disney movie ever) with Billy in the family room, you hear a loud crash in the dining room - the dog knocked over and broke the family's expensive vase!

The parents come home from work and blame you, the babysitter, for breaking the vase. You explain your innocence to the parents as follows:

"Let's suppose that I did break the vase.

This means that I would have had to be in the dining room to break the vase, but I was in the family room watching Toy Story with Billy. Billy can verify that I was in the family room when the vase broke.

If I broke the vase, I would have had to be in two places at once, which is impossible.

I could not have broken the vase!"

You would have used _____ to plead your case.

1. You started by making the temporary assumption that the desired conclusion was false...

I did break vase...

2. You then showed that this assumption lead to a logical impossibility...

cannot be in 2 places @ once

3. So, what you are trying to prove MUST be true...

I did NOT break vase

How to Write an Indirect Proof

1. Identify the statement you want to prove.
2. Temporarily assume that this statement you want to prove is false by assuming the opposite is true.
3. Reason logically until you reach a contradiction.
4. Point out that the desired conclusion must be true because the contradiction proves the temporary assumption false.

**Think "If F, then F ...then overall the statement is true. From Truth Tables!

Example:

1. Write an indirect proof that in a given triangle, there can be at most one right angle.

Given: $\triangle ABC$

Prove: $\triangle ABC$ can have at most one right angle. $\leftarrow$

Temporarily assume: $\triangle ABC$ has at least 2 right $\angle$ s.

Then...

Let's say $\angle A$ and $\angle B$ are the right $\angle$ s. Then $m\angle A = m\angle B = 90^\circ$ by definition. $m\angle A + m\angle B + m\angle C = 180^\circ$ by $\triangle$ sum thm. Then $90 + 90 + m\angle C = 180^\circ$. Then $m\angle C = 0^\circ$. But any angle in a $\triangle$ must be > 0 .

~~✗~~ Since the temp. assumption (a $\triangle$ has at least 2 rt. $\angle$ s) was false, then a $\triangle$ can have only at most 1 rt. $\angle$.

2. Write an indirect proof that a scalene triangle cannot have two congruent angles.

Given: scalene triangle ABC

Prove: $\triangle ABC$ cannot have two congruent angles.

****HINT**:** Use the Converse of the Base Angles Theorem...



Temporarily assume:

$\triangle ABC$ does have 2 $\cong \angle$ s

Then...

Let's say $\angle A \cong \angle B$. Then $\overline{AC} \cong \overline{BC}$ by if $\triangle \rightarrow \angle$. Then $\triangle ABC$ is isosceles by definition. But we were given that $\triangle ABC$ was scalene. ~~✗~~

Since the temp. assumption (that scalene $\triangle ABC$ has 2 $\cong \angle$ s) ~~was false~~, led to a contradiction, then scalene $\triangle ABC$ cannot have 2 $\cong \angle$ s.

WARM UP FOR TOMORROW (do as homework tonight, then share notes with group tomorrow...)

1. Write an indirect proof that an isosceles triangle cannot have a base angle that is a right angle.

Given: isosceles triangle ABC

Prove: $\triangle ABC$ cannot have a base angle that is a right angle