1.4 Beginning Proofs

Lesson Objective: *After studying this section, you will be able to:*

- *Write simple two-column proofs*

Proof - In geometry, a proof is a logically organized series of statements that are supported by geometric principles (step-by-step) so that it is possible to reach a desired conclusion. In scientific language, we start with our hypothesis and end with our logically deduced conclusion. In mathematics, we start with the "givens," then use whatever geometric arguments we need or can prove along the way, in order to finally "prove" the conclusion we were presented with in the problem!

There are **two forms of proofs** we will be working with this year:

- ***The Paragraph Proof,*** *and*
- ***Two Column Proofs***

The form covered in this section is the *Two Column Proof.*

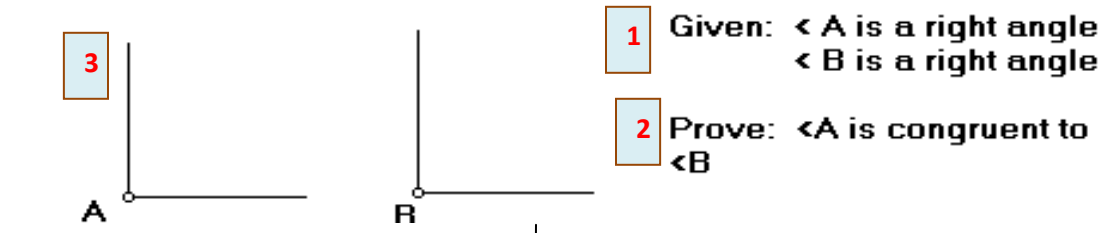
The 5 Parts of a Two-Column Proof:

1. Given information
2. Prove statement
3. Diagram
4. Statement Column
5. Reason Column

Theorem 1: *If two angles are right angles, then they are congruent.*

The following is a two-column proof of Thm 1:

(Note that this proof contains all of the 5 parts)



1 Given: ∠A is a right angle
∠B is a right angle

2 Prove: ∠A is congruent to ∠B

Statements	Reasons
4 1. ∠A is a right angle	5 1. Given information
2. ∠B is a right angle	2. Given information
3. m∠A=90	3. Definition of a right angle
4. m∠B=90	4. Definition of a right angle
5. ∠A is congruent to ∠B	5. Definition of congruent

Once you have proven a theorem you may use it as a reason in another proof.

The four types of REASONS that may be used in a proof are.

1. **Given Information** *(provided in the problem)*

Note: *If you are using allowable assumptions made from the "given" diagram, in the statement and reason columns of your proof you should record:*

stmt: *"diagram as shown"* ***reason:*** *"given"*

stmt: *(your assumption) "____"* ***reason:*** *"assumed from diagram."*

2. **Definitions** *(a minimum amount of information needed to accurately describe the term)*

Note: *A good definition is always reversible, and if your definition is NOT reversible, it is NOT a good definition!*

Example:

good definition: *A line segment is a set of points (true)* $\Leftrightarrow$ *A set of points is a line segment (true)*

bad definition: *A 45° angle is acute (true)* $\not\Leftrightarrow$ *An acute angle is 45° (false!* *There are many possibilities!)*

3. **Postulates** basic assumptions that are based on experience. These statements are accepted as being true without any proof.

Example: Through any two points exactly one line may be drawn

4. **Theorems** – a mathematical statement that can be proved. These are statements that are first suggested and then proven.

Example: You can prove the theorem that "the sum of the measures of the three angles of a triangle is 180°!

Theorem 2: *If two angles are straight angles, then they are congruent.*

This theorem can be proven the same way as above, just substitute, straight for right angles and replace 90 with 180!