# Geometry Unit 3

Proving Theorems

# Proving Theorems

- **Content Objective:** Students will be able to prove theorems using definitions, properties and postulates.
- **Language Objective:** Students will be able to write two-column proofs to prove theorems.

# Theorems

- Statements are proved using:
  - Given Information
  - Definitions
  - Postulates
  - Properties
  - Proven Theorems

# Warmup

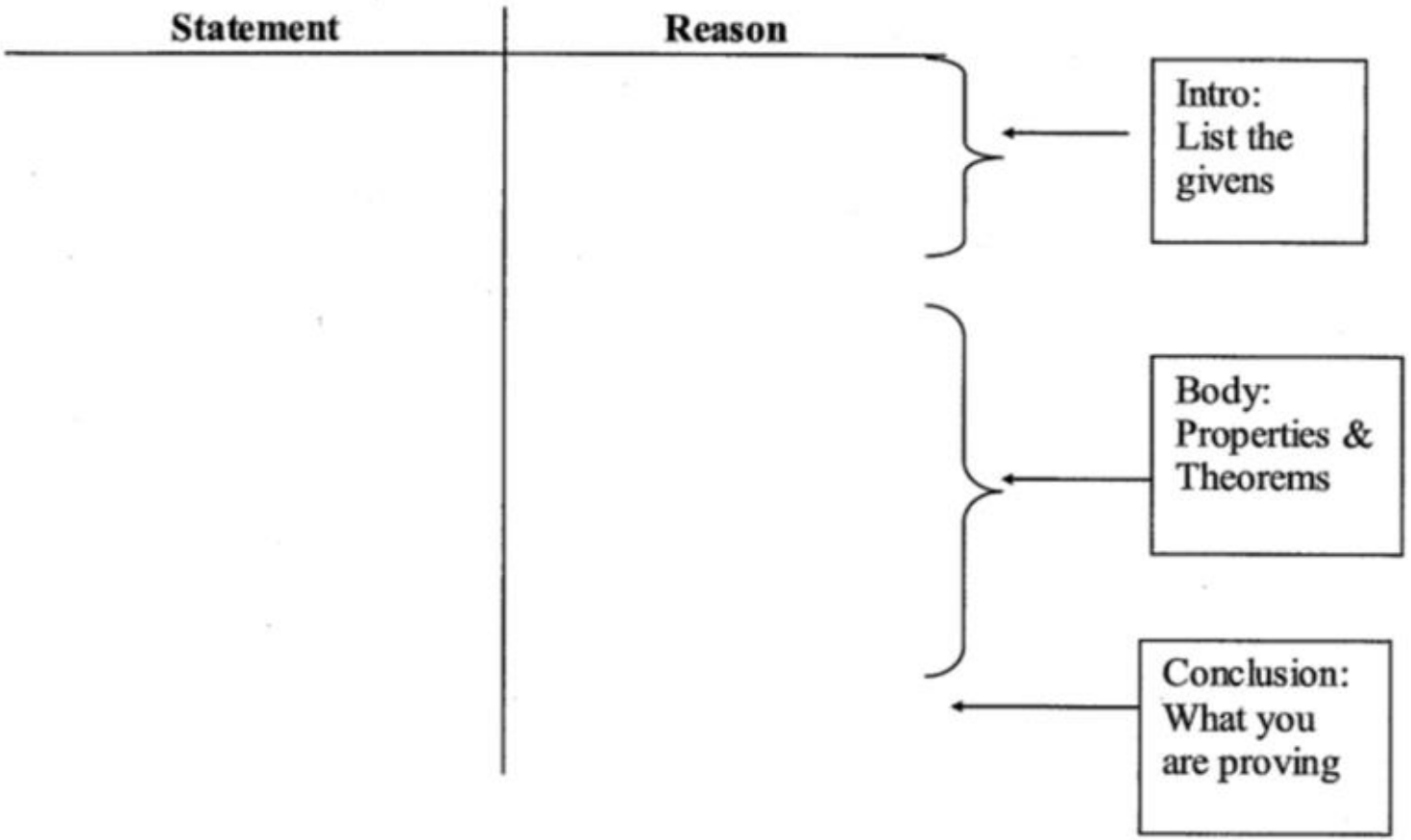
- Prove the Following statement:

Given: AC = BD
Prove: AB = CD


| | |
|---|---|
| 1. AC = BD | 1. Given |
| 2. AC = AB + BC<br>BD = BC + CD | 2. Segment Addition Postulate |
| 3. AB + BC = BC + CD | 3. Transitive Property |
| 4. AB = CD | 4. Subtraction Property |

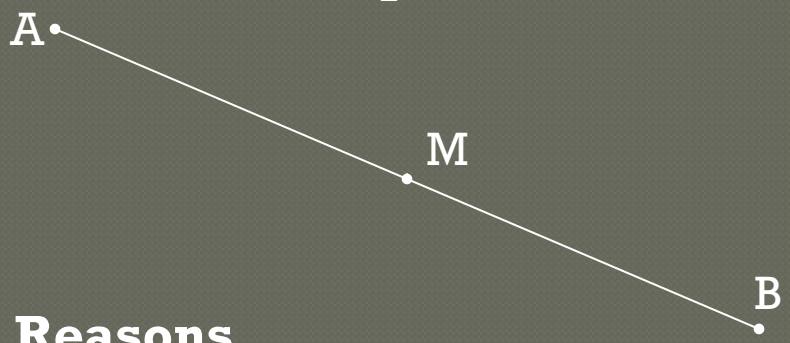
# Two-Column Proofs

***How to set up a proof*:**



# Proving Midpoint Theorem

- **Theorem 2-1:** If M is the midpoint of $\overline{AB}$, then $AM = \frac{1}{2}$AB and $MB = \frac{1}{2}AB$
- Given: M is the midpoint of $\overline{AB}$
- Prove: $AM = \frac{1}{2}AB; MB = \frac{1}{2}AB$




| Statements | Reasons |
|---|---|
| 1. M is the midpoint of $\overline{AB}$ | 1. Given |
| 2. $AM = MB$ | 2. Definition of Midpoint |
| 3. $AM + MB = AB$ | 3. Segment Addition Postulate |
| 4. $AM + AM = AB$; $2AM = AB$ | 4. Substitution Property |
| 5. $AM = \frac{1}{2}AB$ | 5. Division Property |
| 6. $MB = \frac{1}{2}AB$ | 6. Substitution Property |

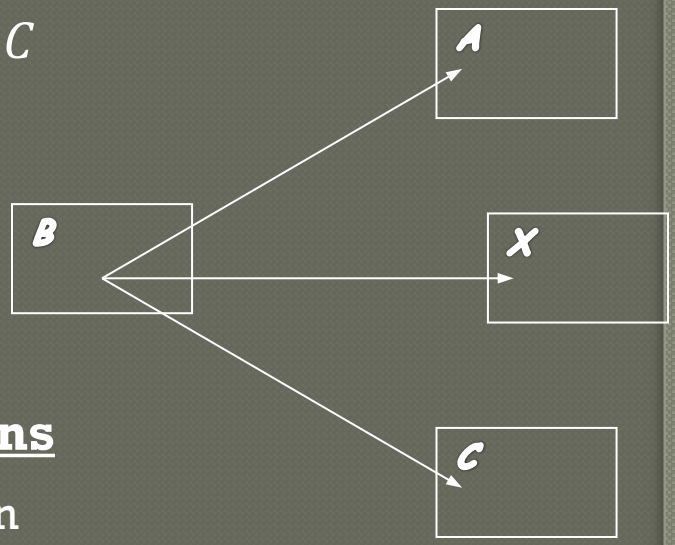
# Deductive Reasoning

- Proving with facts

- In deductive reasoning you are definite, you use definitions.

# Proving Angle Bisector Theorem

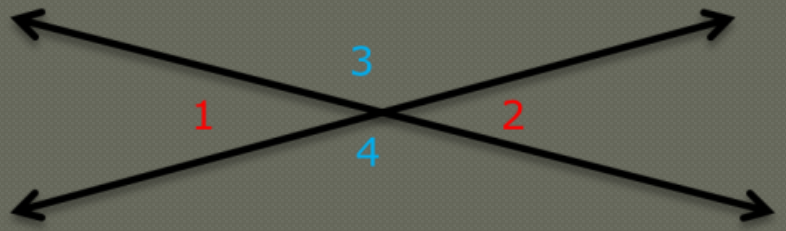
- **Theorem 2-2:** If $\overrightarrow{BX}$ is the angle bisector of $< ABC$, then $m < ABX = \frac{1}{2} m < ABC$ and $m < XBC = \frac{1}{2} m < ABC$
- Given: $\overrightarrow{BX}$ is the angle bisector of $< ABC$
- Prove: $m < ABX = \frac{1}{2} m < ABC$ and $m < XBC = \frac{1}{2} m < ABC$




| Statements | Reasons |
|---|---|
| 1. $\overrightarrow{BX}$ is the angle bisector of $< ABC$ | 1. Given |
| 2. $m < ABX = m < XBC$ | 2. Definition of Angle Bisector |
| 3. $m < ABX + m < XBC = m < ABC$ | 3. Angle Addition Postulate |
| 4. $m < ABX + m < ABX = m < ABC$; $2(m < ABX) = m < ABC$ | 4. Substitution Property |
| 5. $m < ABX = \frac{1}{2} m < ABC$ | 5. Division Property |
| 6. $m < XBC = \frac{1}{2} m < ABC$ | 6. Substitution Property |

# Proving Vertical Angle Theorem

- **Theorem 2-3:** Vertical Angles are congruent.
- Given: < 1 and < 2 are vertical angles
- Prove: $< 1 \cong < 2$




| Statements | Reasons |
|---|---|
| 1. <1 and <2 are Vertical Angles | 1. Given |
| 2. $m < 1 + m < 3 = 180$; $m < 2 + m < 3 = 180$ | 2. Angle Addition Postulate |
| 3. $m < 1 + m < 3 = m < 2 + m < 3$ | 3. Substitution Property |
| 4. $m < 1 = m < 2$ | 4. Subtraction Property |