Geometry Unit 3: Proofs

Perpendicular Lines

Warm-up

- When you just throw out random answers for your proofs, you sound like…

- https://www.youtube.com/watch?v=WckCw_-7e3M

Perpendicular Lines

- **Content Objective:** Students will be able to use the properties of perpendicular lines to prove theorems.

- **Language Objective:** Students will be able to write two-column proofs involving perpendicular lines.

Perpendicular Lines

- **Perpendicular Lines** are two lines that intersect to form right angles.

- Intersecting Lines that form **1** right angle always form **4** right angles.

Perpendicular Lines

- Applications of the Definition:

1. If $\overrightarrow{JK}$ is Perpendicular to $\overleftrightarrow{MN}$, written as $\overrightarrow{JK} \perp \overleftrightarrow{MN}$, then each of the numbered angles is a right angle.
2. If any one of the numbered angles is a right angle, then $\overleftrightarrow{JK} \perp \overleftrightarrow{MN}$.
3. The word Perpendicular can also be used for intersecting rays.

(Ex: If $\overrightarrow{JK} \perp \overleftrightarrow{MN}$ in the diagram, then $\overline{JK} \perp \overline{MN}$ and the sides of < 2 are Perpendicular).

Theorems

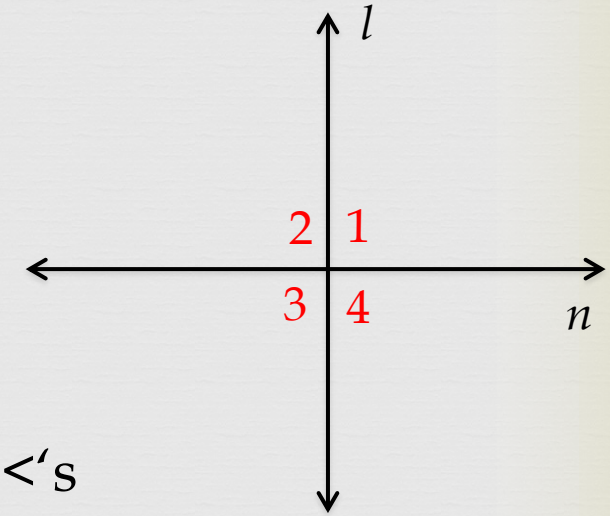
- Statements that are proved using:
  - Given Information
  - Definitions
  - Postulates
  - Properties
  - Proven Theorems

Proving Theorem 2-4

- Theorem 2-4: If two lines are perpendicular, then they form congruent adjacent angles.

Given: $l \perp n$

Prove: $\angle 1, \angle 2, \angle 3, and \angle 4 \; are \cong$ angles



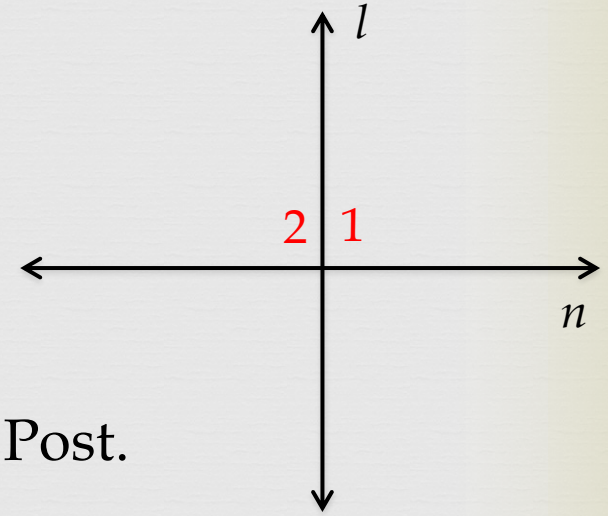
Statements	**Reasons**
1. $l \perp n$	1. Given
2. $\angle 1, \angle 2, \angle 3, \angle 4$ are 90° ∠'s	2. Def. of Perp. ∠'s
3. $\angle 1, \angle 2, \angle 3, \angle 4$ are ≅ ∠'s	3. Def. of ≅ ∠'s

Proving Theorem 2-5

- Theorem 2-5: If two lines are congruent and adjacent angles, then the lines are perpendicular.

Given: $< 1 \cong < 2$

Prove: $l \perp n$



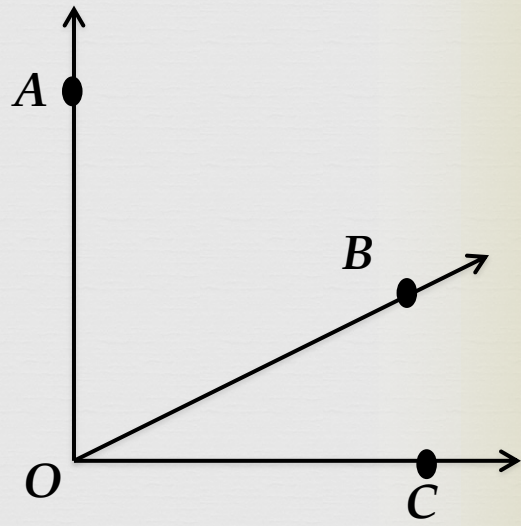
Statements	**Reasons**
1. $< 1 \cong < 2, or\ m < 1 = m < 2$	1. Given
2. $m < 1 + m < 2 = 180°$	2. Angle Add. Post.
3. $m < 1 + m < 1 = 180°;$ $2(m < 1) = 180°$	3. Subst. Prop.
4. $m < 1 = 90°$	4. Div. Prop.
5. $l \perp n$	5. Definition of Perp. Lines

Proving Theorem 2-6

- Theorem 2-6: If the exterior sides of two adjacent acute angles are perpendicular, then the angles are complementary.

Given: $\overrightarrow{OA} \perp \overrightarrow{OC}$

Prove: $< AOB$ and $< BOC$ are comp. <'s



Statements	**Reasons**
1. $\overrightarrow{OA} \perp \overrightarrow{OC}$	1. Given
2. $m < AOC = 90°$	2. Def. of Perp. Rays
3. $m < AOB + m < BOC = m < AOC$	3. Angle Add. Post.
4. $m < AOB + m < BOC = 90°$	4. Subst. Prop.
5. $< AOB$ and $< BOC$ are Comp. <'s	5. Definition of Comp. <'s