# Geometry Unit 4

Properties of Parallel Lines

# Properties of Parallel Lines

- **Content Objective:** Students will be able to use the properties of parallel lines to prove theorems and solve for variables.

- **Language Objective:** Students will be able to identify the properties of parallel lines from labeled diagrams.

# Corresponding Angles

- Postulate 10: If two parallel lines are cut by a transversal, then the corresponding angles are congruent.

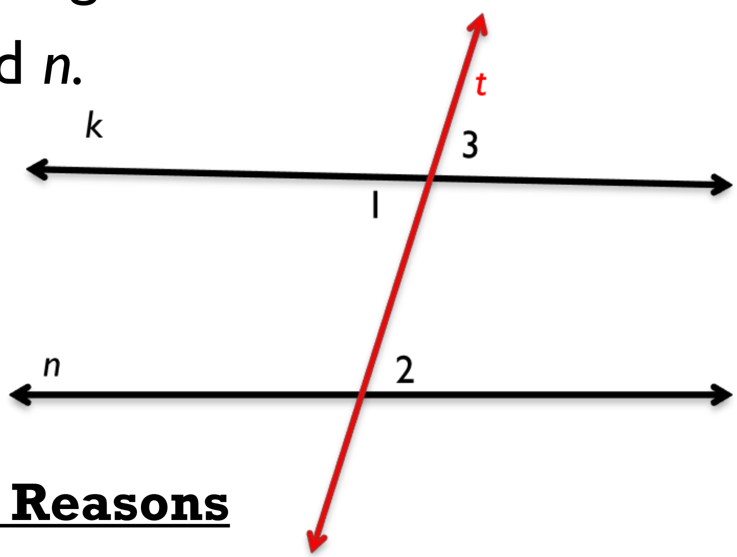
- This postulate is essential for proving the next three theorems.

# Theorem 3-2

<u>Theorem 3-2</u>: If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

Given: *k* ll *n*; transversal *t* cuts *k* and *n*.

Prove: $< 1 \cong < 2$



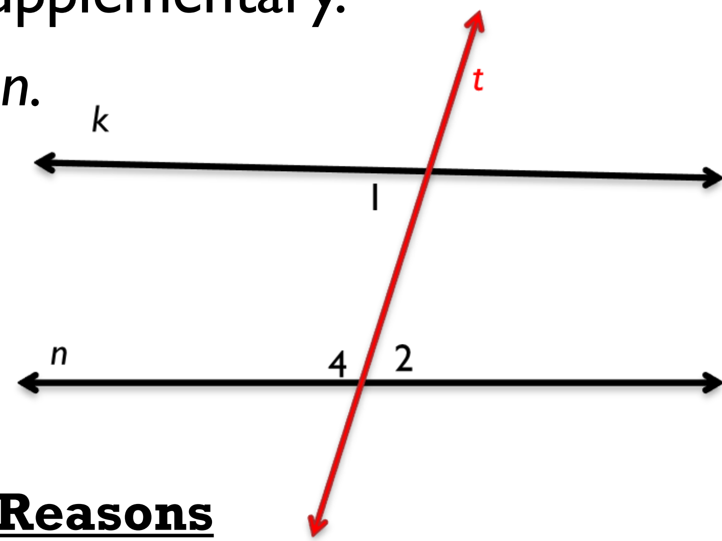

| **Statements** | **Reasons** |
| --- | --- |
| 1. *k* ll *n* | 1. Given |
| 2. $< 1 \cong < 3$ | 2. Vertical Angle Theorem |
| 3. $< 3 \cong < 2$ | 3. If two parallel lines are cut by a transversal, then corr. <'s are ≅ |
| 4. $< 1 \cong < 2$ | 4. Transitive/Substitution Property |

# Theorem 3-3

<u>Theorem 3-3</u>: If two parallel lines are cut by a transversal, then same-side interior angles are supplementary.

Given: *k* ll *n*; transversal *t* cuts *k* and *n*.

Prove: $< 1$ is supplementary to $< 4$.




| **Statements** | **Reasons** |
|---|---|
| *1.* *k* ll *n* | 1. Given |
| 2. $m < 2 + m < 4 = 180$ | 2. Angle Addition Postulate |
| 3. $< 1 \cong < 2 \; or \;\; m < 1 = m < 2$ | 3. If two parallel lines are cut by a transversal, then alt. int. <‘s are ≅ |
| 4. $m < 1 + m < 4 = 180$ | 4. Substitution Property |
| 5. $< 1$ is supplementary to $< 4$. | 5. Def. of Supp. <‘s |

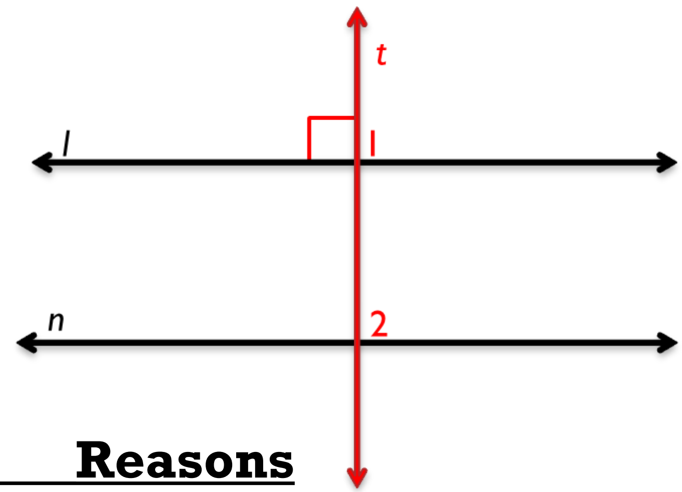
# Theorem 3-4

Theorem 3-4: If a transversal is perpendicular one of two parallel lines, then it is perpendicular to the other line also.

Given: transversal *t* cuts *l* and *n*;

$t \perp l; l \parallel n$

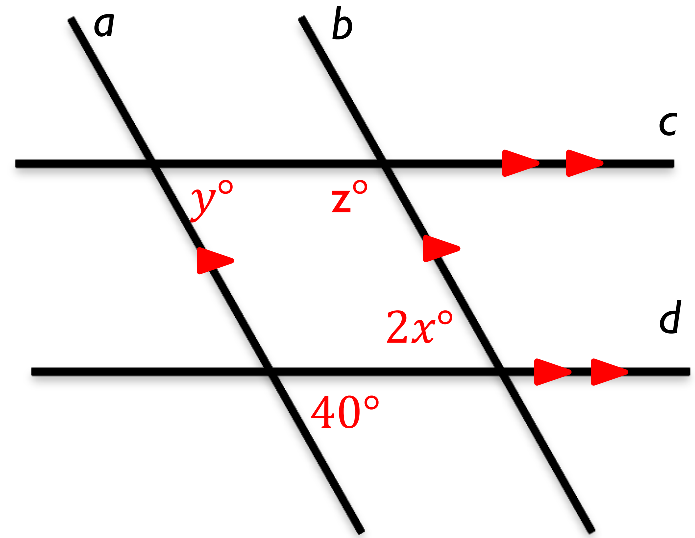
Prove: $t \perp n$




| Statements | Reasons |
|---|---|
| 1. $t \perp l$ | 1. Given |
| 2. $m < 1 = 90$ | 2. Def. of perpendicular lines |
| 3. $l \parallel n$ | 3. Given |
| 4. $< 2 \cong < 1$ or $m < 2 = m < 1$ | 4. If two parallel lines are cut by a transversal, then corr. <'s are $\cong$ |
| 5. $m < 2 = 90$ | 5. Substitution Property |
| 6. $t \perp n$ | 6. Def. of perpendicular lines |

# Using the Properties

Find the values of *x*, *y*, and *z*.




Since a ll b, $2x = 40$ (Why?)

Thus, $x = 20$

Since c ll d, $y = 40$ (Why?)

Since a ll b, $y + z = 180$ (Why?)

$$40 + z = 180$$

$$z = 140$$