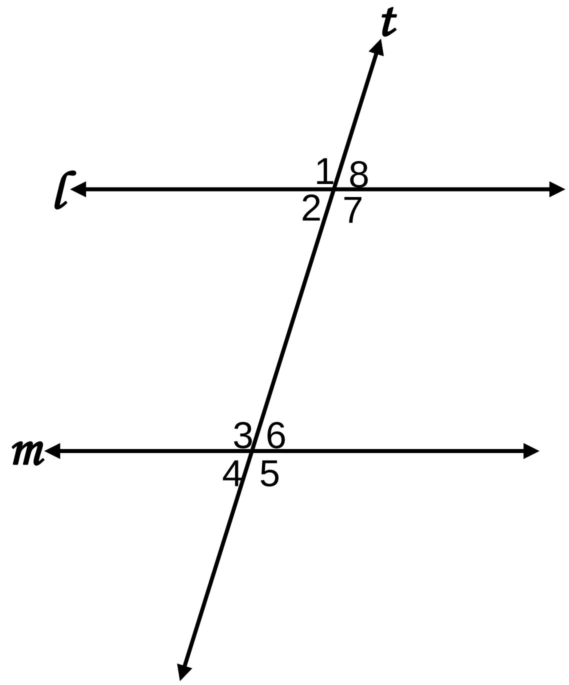
# Notes: **PROOFS OF PARALLEL LINES**

**Content Objective:** ***I will apply the relationships between the measures of the angle pairs formed by two parallel lines cut by a transversal to proofs.***

**EXAMPLE 1: Use the diagram on the right to complete the following theorems/postulates.**

**THEOREMS/POSTULATES**




If two parallel lines are cut by a transversal, then ***alternate interior*** angles are _______________.

If two parallel lines are cut by a transversal, then ***same-side interior*** angles are _______________.

If two parallel lines are cut by a transversal, then ***alternate exterior*** angles are _______________.

If two parallel lines are cut by a transversal, then ***same-side exterior*** angles are _______________.

If two parallel lines are cut by a transversal, then ***corresponding*** angles are _______________.

**QUICK CHECK: Use the theorems/postulates from Example 1 to justify the following conclusions.**

**a.** $\angle 2 + \angle 3 = 180°$ **because** ______________________________________________________ .

**b.** $\angle 2 \cong \angle 4$ **because** ______________________________________________________ .

**c.** $\angle 4 \cong \angle 8$ **because** ______________________________________________________ .

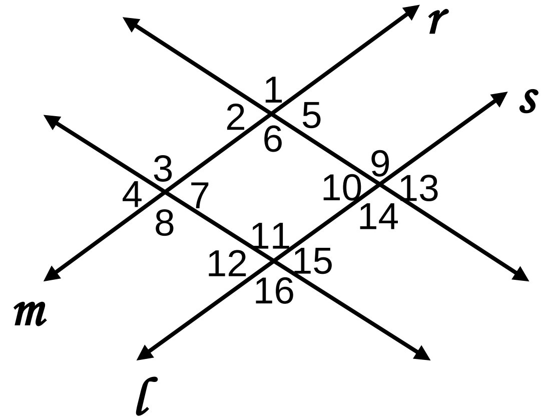
**d.** $\angle 8 + \angle 5 = 180°$ **because** ______________________________________________________ .

**e.** $\angle 1 \cong \angle 7$ **because** ______________________________________________________ .

**f.** $\angle 8 + \angle 7 = 180°$ **because** ______________________________________________________ .

**EXAMPLE 2: Given: r || s**
**m || l**

**Prove: m ∠ 5 + m ∠ 11 = 180°**



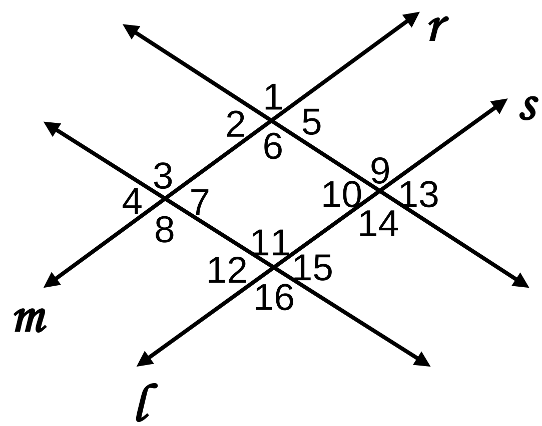

Fill in any missing statements or reasons to complete the proof.

| Statements | Reasons |
|---|---|
| 1. | 1. Given |
| 2. ∠ 5 & ∠ 9 are supplementary. | 2. |
| 3. | 3. Definition of supplementary angles |
| 4. | 4. |
| 5. | 5. Corresponding Angles Postulate |
| 6. m ∠ 9 = m ∠ 11 | 6. |
| 7. | 7. Substitution |

**QUICK CHECK: Given: r || s**

**m || l**

**Prove: m ∠ 3 ≅ m ∠ 14**




Fill in any missing statements or reasons to complete the proof.

| Statements | Reasons |
|---|---|
| 1. | 1. Given |
| 2. ∠ 3 ≅ ∠ 6 | 2. |
| 3. | 3. Given |
| 4. ∠ 6 ≅ ∠ 14 | 4. |
| 5. | 5. Transitive Property of Equality |

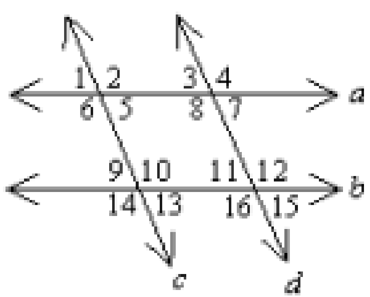
**We can also prove lines parallel using the *converse* of the following statement:**

If two parallel lines are cut by a transversal, then alternate interior angles are _____________.

**The converse is:** If two lines in a plane are cut by a transversal and alternate interior angles are congruent, then the two lines are ____________.

| IF | THEN |
|---|---|
| Corresponding angles are **congruent.**<br><br>Alternate interior angles are **congruent.**<br><br>Alternate exterior angles are **congruent.**<br><br>Consecutive interior angles are **supplementary.**<br><br>The lines are **perpendicular** to the same line. | The lines are **PARALLEL** |

**EXAMPLE 4: Given the following information, determine which lines, if any, are parallel. State the postulate or theorem that justifies your answer.**




a. $\angle 8$ & $\angle 11$

Postulate/Theorem: ___________________________

b. $\angle 12$ & $\angle 14$

Postulate/Theorem: ___________________________

**QUICK CHECK:**

a. $\angle 10$ & $\angle 2$

Postulate/Theorem: ___________________________

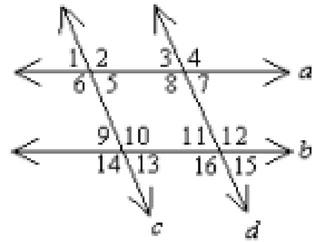
b. $\angle 5$ & $\angle 3$

Postulate/Theorem: ___________________________

**EXAMPLE 5: Fill in any missing statements or reasons to complete the proof.**

Given: *c ll d;* $\angle 1 \cong \angle 15$

Prove: a *ll b*

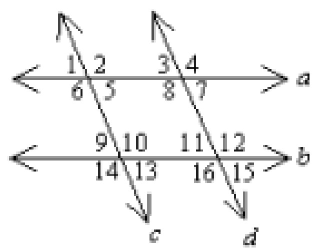



| Statements | Reasons |
|---|---|
| 1. *c ll d* | 1. |
| 2. $\angle 1 \cong \angle 3$ | 2. Corresponding Angles are ______________ |
| 3. $\angle 1 \cong \angle 15$ | 3. |
| 4. $\angle 15 \cong \angle$____ | 4. Transitive Property |
| 5. a *ll b* | 5. Converse of Alternate Exterior Angles |

**QUICK CHECK:**

Given: a *ll b;* $\angle 2 \cong \angle 12$

Prove: *c ll d*




| Statements | Reasons |
|---|---|
| 1. *a ll b* | 1. |
| 2. $\angle 12 \cong \angle 8$ | 2. __________ ___________Angles are congruent |
| 3. $\angle 2 \cong \angle 12$ | 3. |
| 4. $\angle 8 \cong \angle$____ | 4. Transitive Property |
| 5. *c ll d* | 5. Converse of _________ ________ Angles |