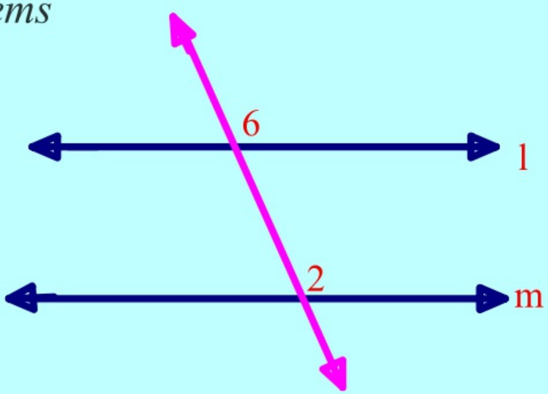
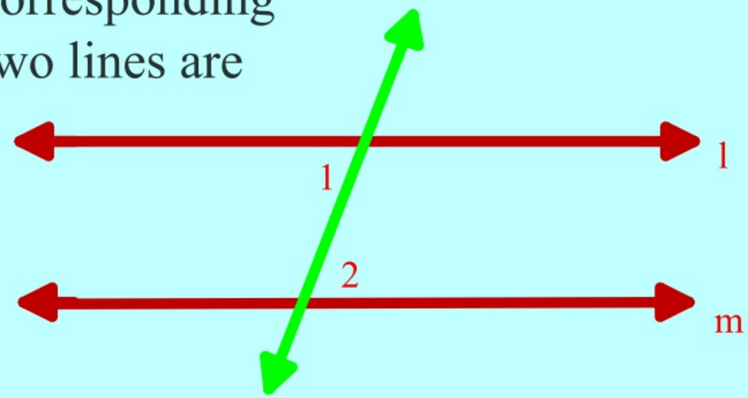
# 3-2 Proving Lines Parallel

*The previous section (3-1 Properties of Parallel Lines) proved angles are congruent knowing the lines were parallel. In this section (3-2 Proving Lines Parallel) we will learn about postulates and theorems that are the converse of the postulates and theorems from 3-1. We will be proving lines are parallel knowing certain angles are congruent.*




**Postulate 3-2:**
**Converse of the Corresponding Angles Postulate:**

If two lines and a transversal form corresponding angles that are congruent, then the two lines are parallel.

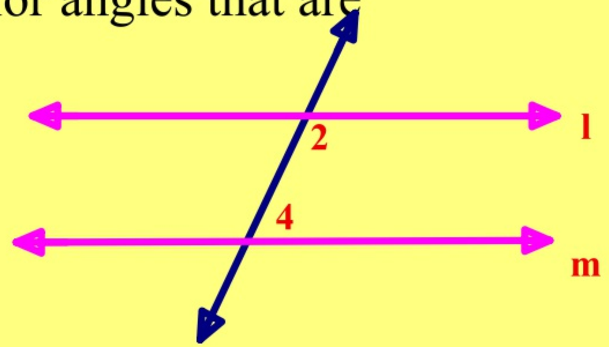



**Theorem 3-5:**
**Converse of the Alternate Interior Angles Theorem**

If two lines and a transversal form alternate interior angles that are congruent, then the two lines are parallel.

If $\angle 1 \cong \angle 2$, then $l \parallel m$.

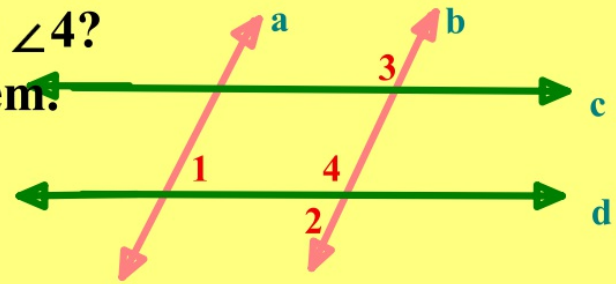
**Theorem 3-6: Converse of Same-Side Interior Angles Theorem**
If two lines and a transversal form same-side interior angles that are supplementary, then the two lines are parallel.




**If $\angle 2$ and $\angle 4$ are supplementary, then l || m.**

**Examples:**

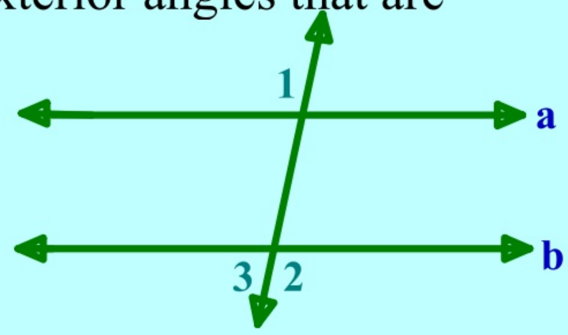
**1.)Which lines, if any, must be parallel if $\angle 3 \cong \angle 4$? Justify your answer with a postulate or theorem.**




**2.)Which lines, if any, must be parallel if angle 3 and angle 2 are supplementary? Justify your answer with a postulate or theorem.**

**Theorem 3-7: Converse of Alternate Exterior Angles Theorem**

If two lines and a transversal form alternate exterior angles that are congruent, then the two lines are parallel.

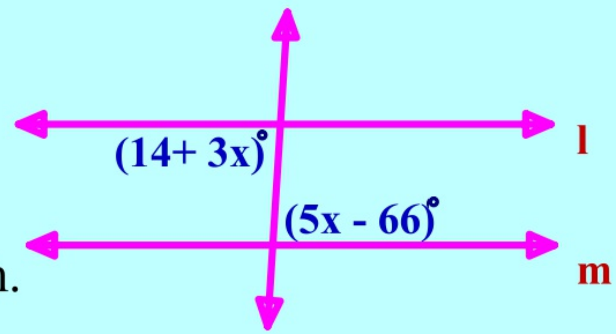



If $\angle 1 \cong \angle 2$, then a || b.

**Theorem 3-8: Converse of Same-side Exterior Angles Theorem**

If two lines and a transversal form same-side exterior angles that are supplementary, then the two lines are parallel.

If $\angle 1$ and $\angle 3$are supplementary, then a || b.




Example:

3.) Find the value of x for which l is parallel to m.

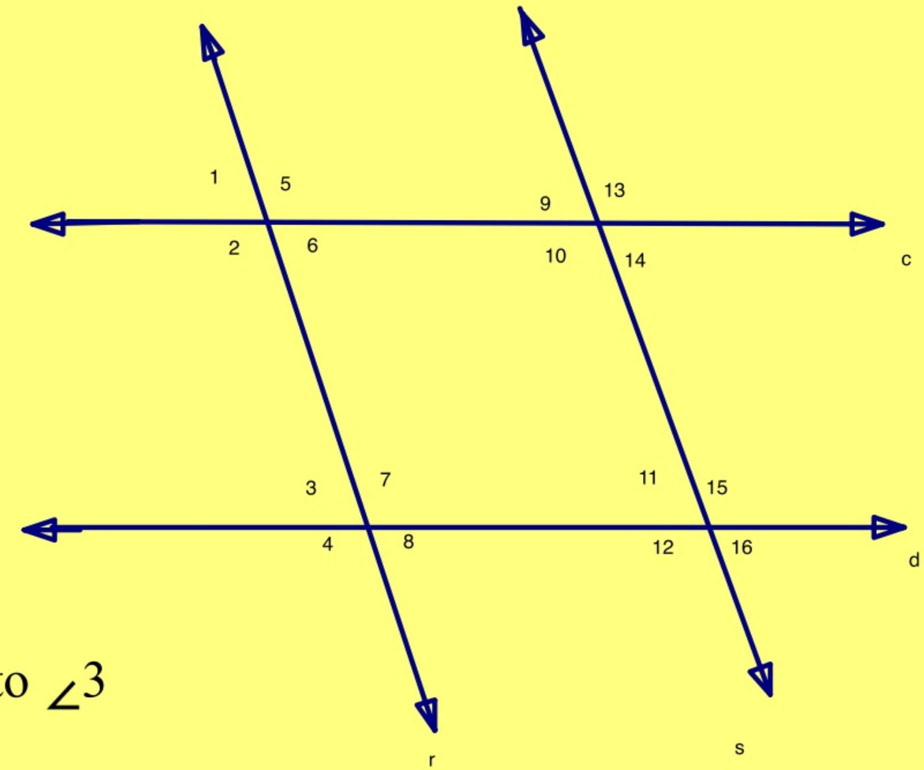
4.) Using the diagram below, determine which lines, if any, must be parallel. If any lines are parallel, use a theorem or postulate to tell why.

a.) $\angle 1 \cong \angle 9$

b.) $\angle 7 \cong \angle 10$

c.) $\angle 10 \cong \angle 15$

d.) $\angle 2$ is supplementary to $\angle 3$

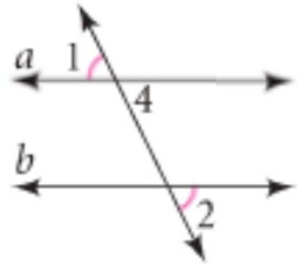


Read through the two-cloumn proof of Theorem 3-7 (Converse of the Alternate Exterior Angles Theorem) on page 136.

**Proof**

## Proof of Theorem 3-7

If two lines and a transversal form alternate exterior angles that are congruent, then the two lines are parallel.

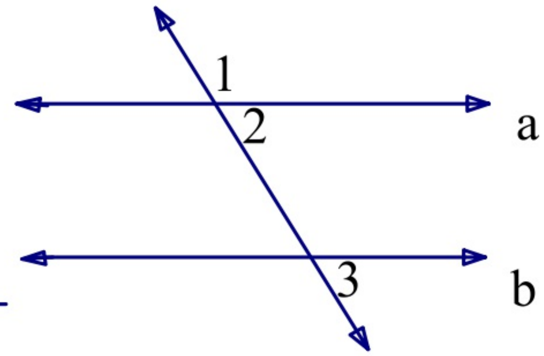



**Given:** $\angle 1 \cong \angle 2$

**Prove:** $a \parallel b$

| Statements | Reasons |
|---|---|
| **1.** $\angle 1 \cong \angle 2$ | **1.** Given |
| **2.** $\angle 1 \cong \angle 4$ | **2.** Vertical angles are congruent. |
| **3.** $\angle 2 \cong \angle 4$ | **3.** Transitive Property of Congruence |
| **4.** $a \parallel b$ | **4.** If two lines and a transversal form congruent corresponding angles, then the lines are parallel. |

5.) Let's complete the **proof of Theorem 3-8** together.

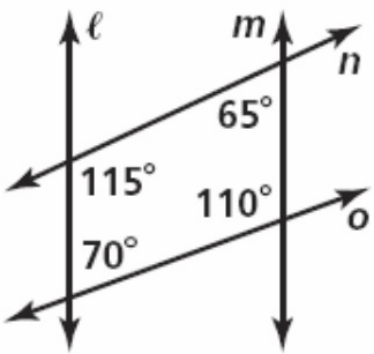



**Given**: m 1 + 3 = 180
**Prove**: a || b

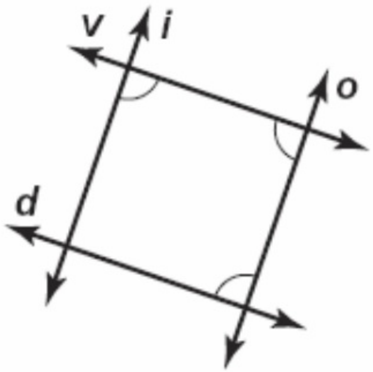
| **Statements** | **Reasons** |
|---|---|
| 1.) $m\angle 1 + m\angle 3 = 180$ | 1.) |
| 2.) $m\angle 1 + m\angle 2 = 180$ | 2.) |
| 3.) $m\angle 1 + m\angle 3 = m\angle 1 + m\angle 2$ | 3.) |
| 4.) $m\angle 3 = m\angle 2$ | 4.) |
| 5.) a \|\| b | 5.) |

**Which lines or segments are parallel? Justify your answer with a theorem or postulate.**

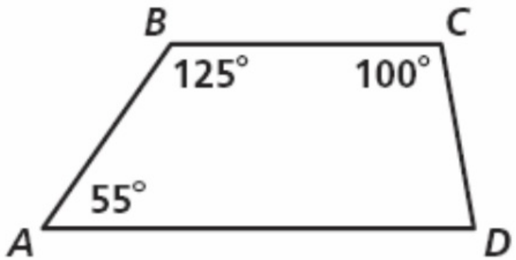
1. ______________________



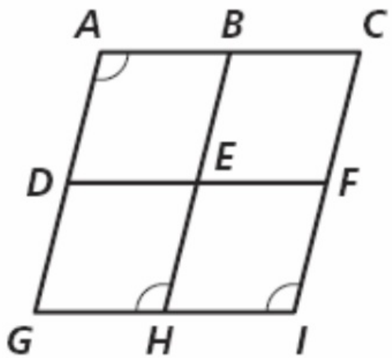

2. ______________________




3. ______________________

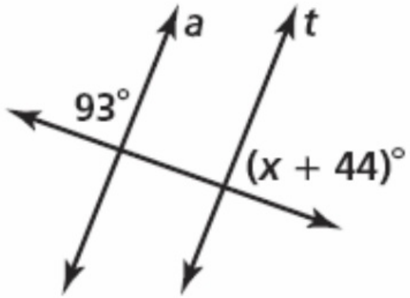



4. ______________________

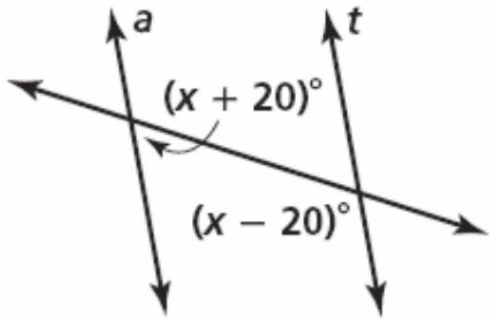


*Algebra* **Find the value of $x$ for which $a \parallel t$.**

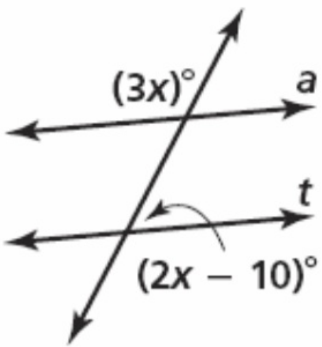
**5.** ______________________




**6.** ______________________




**7.** ______________________




**8.** ______________________