Parallel lines are lines in the same plane that never intersect (that have the same slope). If two lines, $l_1$ and $l_2$, are parallel, we say $l_1 \parallel l_2$.

Transversal — a line that intersects two or more lines on the same plane.
Special Angles

Certain angle pairs are given special names based on their relative position to one another or based on the sum of their respective measures.

Angle Pairs Created with a Transversal

A **transversal** is any line that intersects two or more lines in the same plane but at different points. In Figure 1, line $t$ is a transversal.

![Figure 1](image1.png)

A transversal intersecting two lines in the same plane.

A transversal that intersects two lines forms eight angles; certain pairs of these angles are given special names. They are as follows:

- **Corresponding angles** are the angles that appear to be in the same relative position in each group of four angles. In Figure 2, $\angle 1$ and $\angle 5$ are corresponding angles. Other pairs of corresponding angles in Figure 2 are: $\angle 4$ and $\angle 8$, $\angle 2$ and $\angle 6$, and $\angle 3$ and $\angle 7$.

![Figure 2](image2.png)

Figure 2 A transversal intersecting two lines and forming various pairs of corresponding angles—alternate interior angles, alternate exterior angles, consecutive interior angles, and consecutive exterior angles.
• **Alternate interior angles** are angles within the lines being intersected, on opposite sides of the transversal, and are not adjacent. In Figure 2, ∠4 and ∠6 are alternate interior angles. Also, ∠3 and ∠5 are alternate interior angles.

• **Alternate exterior angles** are angles outside the lines being intersected, on opposite sides of the transversal, and are not adjacent. In Figure 2, ∠1 and ∠7 are alternate exterior angles. Also, ∠2 and ∠8 are alternate exterior angles.

• **Consecutive interior angles** (same-side interior angles) are interior angles on the same side of the transversal. In Figure 2, ∠4 and ∠5 are consecutive interior angles. Also, ∠3 and ∠6 are consecutive interior angles.

• **Consecutive exterior angles** (same-side exterior angles) are exterior angles on the same side of the transversal. In Figure 2, ∠1 and ∠8 are consecutive exterior angles. Also, ∠2 and ∠7 are consecutive exterior angles.
Parallel Lines Definitions, Postulates and Theorems

**Postulate 11: (Corresponding Angles Postulate)**
If two parallel lines are cut by a transversal, then the corresponding angles are congruent.

(Figure 1).

(Figure 1) Corresponding angles are congruent when two parallel lines are cut by a transversal.

**Theorem 2.1.2: (Alternate Interior Angles Theorem)**
If two parallel lines are cut by transversal, then the alternate interior angles are congruent.

**Theorem 2.1.3: (Exterior Angle Theorem)** If two parallel lines are cut by transversal, then the alternate exterior angles are congruent.

As long as you know one angle, you can figure out all the corresponding, alternate interior and alternate exterior angles made by a transversal cutting through parallel lines.
PARALLEL POSTULATES AND SPECIAL ANGLES (Chapter 2.1)

**Theorem 2.1.4: (Interior Angles on Same Side Theorem)**
If two parallel lines are cut by transversal, then the interior angles on the same side are supplementary.

This theorem says that if \( l \parallel m \), then
- \( m \angle 4 + m \angle 5 = 180^\circ \)
- \( m \angle 3 + m \angle 6 = 180^\circ \)

**Theorem 2.1.5: (Exterior Angles on Same Side Theorem)**
If two parallel lines are cut by transversal, then the exterior angles on the same side are supplementary.

This theorem says that if \( l \parallel m \), then
- \( m \angle 2 + m \angle 7 = 180^\circ \)
- \( m \angle 1 + m \angle 8 = 180^\circ \)
PARALLEL POSTULATES AND SPECIAL ANGLES (Chapter 2.1)

Example 1: Prove the Alternate Interior Angles Theorem.

GIVEN: \(a \parallel b\) in Figure 2.8
Transversal \(k\)

PROVE: \(\angle 3 \cong \angle 6\)

![Figure 2.8](image)

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (a \parallel b); transversal (k)</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. (\angle 2 \cong \angle 6)</td>
<td>2. If two (\parallel) lines are cut by a transversal, corresponding (\angle)s are (\cong) (Corresponding Angles Postulate)</td>
</tr>
<tr>
<td>3. (\angle 3 \cong \angle 2)</td>
<td>3. If two lines intersect, vertical (\angle)s formed are (\cong) (Vertical Angles Postulate)</td>
</tr>
<tr>
<td>4. (\angle 3 \cong \angle 6)</td>
<td>4. Transitive (of (\cong))</td>
</tr>
</tbody>
</table>

Example 2:

Given that \(l_1 \parallel l_2\), solve for \(x\)

\[\angle 1 = (3x + 20)^\circ\]

\[\angle 2 = (3x - 80)^\circ\]

Which theorem can you use to solve this?