Lines and Transversal Notes

Key Vocabulary

Parallel Lines

Parallel lines are lines that will never intersect. We write $n \parallel m$.

Perpendicular lines

Perpendicular lines are lines that intersect to form 90° angles. We write $p \perp q$. 

**Vertical Angles** – When two lines intersect, they form four angles. The angles that are across from each other are vertical angles.

In the diagram above, ∠1 and ∠2 are vertical angles. ∠3 and ∠4 are also vertical angles. The measurements of vertical angles are equal (m∠1 = m∠2 and m∠3 = m∠4).

Transversal – a line that intersects two or more other lines.

When a transversal intersects two lines, it creates eight angles. These angles have special relationships:

*Interior Angles* – angles that are between the two lines that are intersected by the transversal. In the diagram above, they are angles 3, 4, 5, and 6.

*Exterior Angles* - angles that are NOT between the two lines that are intersected by the transversal. In the diagram above, they are angles 1, 2, 7, and 8.
Alternate Interior Angles – interior angles that are the opposite sides of the transversal. In the diagram above, they are angles 3 and 6 as well as angles 4 and 5.

Alternate Exterior Angles - exterior angles that are the opposite sides of the transversal. In the diagram above, they are angles 1 and 8 as well as angles 2 and 7.

Corresponding Angles – angles that are in the same relative position. In the diagram above, they are angles 1 and 5; angles 2 and 6; angles 3 and 7; and angles 4 and 8.

Interior Angles on the same side of the transversal - interior angles that are the same side of the transversal. In the diagram above, they are angles 3 and 5 as well as angles 4 and 6.

If the lines being intersected but the transversal are parallel ($e \parallel f$), then all of the above sets of angles are congruent (equal in measurement) except for interior angles on the same side of the transversal. Those are supplementary ($m\angle 3 + m\angle 5 = 180^\circ$ and $m\angle 4 + m\angle 6 = 180^\circ$).

Examples

Example 1

On the map, Third and Fourth Street are parallel to each other. Olympic Ave. crosses both streets. What is the measure of $\angle 7$?

![Diagram showing angles 3 and 5 are supplementary, each measuring 55°.](image)
Angle 7 is an alternate exterior angle with the angle equal to 55°. Since Third and Fourth Street are parallel, the two angles are congruent. Hence, \( m\angle 7 = 55° \).

**Example 2**

Which of the following is a true statement about the angles in the drawing below?

If \( m\angle 2 = 105° \) and \( m\angle 5 = 58° \) then ________________

A) \( p \parallel q \)
B) \( \angle 7 \cong \angle 3 \)
C) \( m\angle 8 + 105° = 180 \)
D) \( m\angle 8 = 58° \)

The answer is D. Since \( \angle 5 \) and \( \angle 8 \) are vertical angles, they are congruent. Hence, \( m\angle 8 = 58° \).
Example 3

Three line segments form the letter N. In the drawing, $\overline{AB} \parallel \overline{CD}$. Reflex angle $\angle C$ measures $290^\circ$. What is the measure of $\angle ABC$?

Solution: If reflex $\angle C = 290^\circ$, then $\angle C = 360^\circ - 290^\circ = 70^\circ$. $\angle ABC$ and $\angle C$ are alternate interior angles. Since $\overline{AB} \parallel \overline{CD}$, the two angles are equal in measurement. Therefore, $m \angle ABC = 70^\circ$. 