Name: ______________________________ Per: ______

Determining if Lines are Parallel

For two-column proofs about **lines cut by a transversal**, you can use parallel lines to **prove angle relationships** or angle relationships to **prove lines are parallel** (always uses **converse**).

There are eight proof properties

Proving Angle Relationships (end with angles)	**Proving Lines Parallel (end with parallel lines)**

<u>Corresponding Angles Postulate:</u> If the lines are parallel, then corresponding angles are congruent.
<u>EXAMPLE:</u> $\angle 6$ and $\angle 7$ are corresponding angles on lines a and b. $a \parallel b$.

Statements	Reasons
1. $a \parallel b$	1. Given
2. $\angle 6 \cong \angle 7$	2. **Corresponding Angles Postulate**

<u>Converse of the Corresponding Angles Postulate:</u> If corresponding angles are congruent, then the lines are parallel.
<u>EXAMPLE:</u> $\angle 6$ and $\angle 7$ are corresponding angles on lines a and b. $\angle 6 \cong \angle 7$.

Statements	Reasons
1. $\angle 6 \cong \angle 7$	1. Given
2. $a \parallel b$	2. **<u>Converse</u> of the Corresponding Angles Postulate**

<u>Alternate Interior Angles Theorem:</u> If the lines are parallel, then alternate interior angles are congruent.
<u>EXAMPLE:</u> $\angle 2$ and $\angle 5$ are alternate interior angles on lines m and n. $m \parallel n$.

Statements	Reasons
1. $m \parallel n$	1. Given
2. $\angle 2 \cong \angle 5$	2. **Alternate Interior Angles Theorem**

<u>Converse of the Alternate Interior Angles Theorem:</u> If alternate interior angles are congruent, then the lines are parallel.
<u>EXAMPLE:</u> $\angle 2$ and $\angle 5$ are alternate interior angles on lines m and n. $\angle 2 \cong \angle 5$.

Statements	Reasons
1. $\angle 2 \cong \angle 5$	1. Given
2. $m \parallel n$	2. **<u>Converse</u> of the Alternate Interior Angles Theorem**

<u>Alternate Exterior Angles Theorem:</u> If the lines are parallel, then alternate exterior angles are congruent.
<u>EXAMPLE:</u> $\angle 1$ and $\angle 3$ are alternate exterior angles on lines p and q. $p \parallel q$.

Statements	Reasons
1. $p \parallel q$	1. Given
2. $\angle 1 \cong \angle 3$	2. **Alternate Interior Angles Theorem**

<u>Converse of the Alternate exterior Angles Theorem:</u> If alternate exterior angles are congruent, then the lines are parallel.
<u>EXAMPLE:</u> $\angle 1$ and $\angle 3$ are alternate exterior angles on lines a and b. $\angle 1 \cong \angle 3$.

Statements	Reasons
1. $\angle 1 \cong \angle 3$	1. Given
2. $p \parallel q$	2. **<u>Converse</u> of the Alternate Interior Angles Theorem**

<u>Same Side Interior Angles Theorem:</u> If the lines are parallel, then same side interior angles add to equal 180˚.
<u>EXAMPLE:</u> $\angle 8$ and $\angle 9$ are same side interior angles on lines t and v. $t \parallel v$.

Statements	Reasons
1. $t \parallel v$	1. Given
2. $m\angle 8 + m\angle 9 = 180^\circ$	2. **Same Side Interior Angles Theorem**

<u>Converse of the Same Side Interior Angles Theorem:</u> If same side interior angles add to equal 180˚, then the lines are parallel.
<u>EXAMPLE:</u> $\angle 8$ and $\angle 9$ are same side interior angles on lines t and v. $m\angle 8 + m\angle 9 = 180^\circ$.

Statements	Reasons
1. $m\angle 8 + m\angle 9 = 180^\circ$	1. Given
2. $t \parallel v$	2. **<u>Converse</u> of the Same Side Interior Angles Theorem**

Fill in the missing parts to each two-column proof.

1. $\angle 1$ and $\angle 2$ are alternate interior angles on lines a & b. $a \parallel b$.

Statements	Reasons
1. $a \parallel b$	1. Given
2. $\angle 1 \cong \angle 2$	2. ____________________

2. $\angle 9$ and $\angle 10$ are alternate exterior angles on lines m & n. $\angle 9 \cong \angle 10$.

Statements	Reasons
1. $\angle 9 \cong \angle 10$	1. Given
2. $m \parallel n$	2. ____________________

3. $\angle 2$ and $\angle 6$ are corresponding angles on lines x & y. $x \parallel y$.

Statements	Reasons
1. $x \parallel y$	1. Given
2. $\angle 2 \cong \angle 6$	2. ____________________

4. $\angle 2$ and $\angle 4$ are same side interior angles on lines q & t. $m\angle 2 + m\angle 4 = 180^\circ$.

Statements	Reasons
1. $m\angle 2 + m\angle 4 = 180^\circ$	1. Given
2. $q \parallel t$	2. ____________________

5. $\angle 3$ and $\angle 4$ are corresponding angles on lines r & s. $\angle 3 \cong \angle 4$.

Statements	Reasons
1. $\angle 3 \cong \angle 4$	1. Given
2. $r \parallel s$	2. ____________________

6. $\angle 5$ and $\angle 6$ are same side interior angles on lines c & d. $c \parallel d$.

Statements	Reasons
1. $c \parallel d$	1. Given
2. $m\angle 1 + m\angle 2 = 180^\circ$	2. ____________________

7. $\angle 6$ and $\angle 8$ are alternate exterior angles on lines f & g. $f \parallel g$.

Statements	Reasons
1. $f \parallel g$	1. Given
2. $\angle 6 \cong \angle 8$	2. ____________________

8. $\angle 11$ and $\angle 12$ are alternate interior angles on lines y & z. $\angle 11 \cong \angle 12$.

Statements	Reasons
1. $\angle 11 \cong \angle 12$	1. Given
2. $y \parallel z$	2. ____________________

Now, try your hand at more complicated proofs.

9.
Given: $\angle 3$ and $\angle 4$ are same side interior angles on lines a & b. $m\angle 3 = 60^\circ$. $m\angle 4 = 120^\circ$.
Prove: $a \parallel b$

Statements	Reasons
1. $m\angle 3 = 60^\circ$ $m\angle 4 = 120^\circ$	1. ____________________
2. $m\angle 3 + m\angle 4 = 60 + 120$	*Hint: I plugged in stuff* 2. ____________________
3. $m\angle 3 + m\angle 4 = 180^\circ$	3. ____________________
4. $a \parallel b$	4. ____________________

10.
Given: $\angle 1$ and $\angle 2$ are corresponding angles on lines c & d. $c \parallel d$. $m\angle 1 = 5x^\circ$. $m\angle 2 = (4x + 20)^\circ$.
Prove: $m\angle 1 = 100^\circ$

Statements	Reasons
1. $m\angle 1 = 5x^\circ$ $m\angle 2 = (4x + 20)^\circ$	1. ____________________
2. $c \parallel d$	2. ____________________
3. $\angle 1 \cong \angle 2$	3. ____________________
4. $m\angle 1 = m\angle 2$	4. ____________________
5. $5x = 4x + 20$	5. ____________________
6. $x = 20$	6. ____________________
7. $m\angle 1 = 5(20)$	7. ____________________
8. $m\angle 1 = 100^\circ$	8. ____________________