Geometry Investigation 1
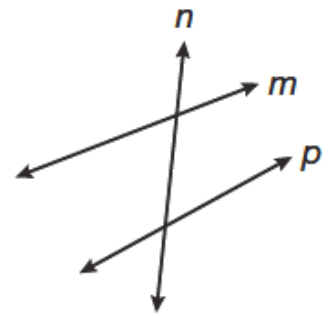
Transversals and Angle Relationships

A _____ is a line that intersects two or more coplanar lines at different points.

> **Math Language**
>
> Recall that an **angle** is defined as a figure formed by two rays and a common endpoint. It is represented by the symbol ∠.

1. Identify the transversal.
2. How many angles are formed by a transversal crossing two lines?

When two lines are intersected by a transversal, the angles formed are classified according to four types of angle pairs. The example column shows two angles that fit each classification.
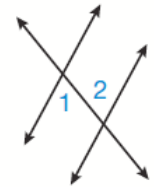
Classification   Example

A pair of _____ angles is any pair of angles that lie on the same side of the transversal and on the same sides of the other two lines.
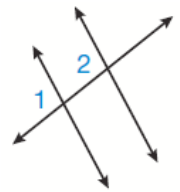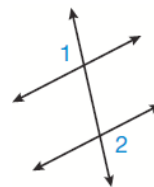
A pair of alternate _____ angles is any pair of nonadjacent angles that lie on opposite sides of the transversal and between the other two lines.

A pair of alternate _____ angles is any pair of angles that lie on opposite sides of the transversal and outside the other two lines.
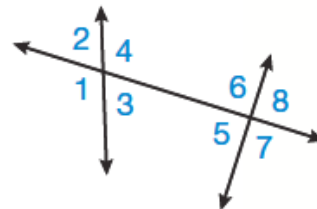
The _____-_____ interior angles, also called the consecutive interior angles, are a pair of angles that lie on the same side of the transversal and between the other two lines.
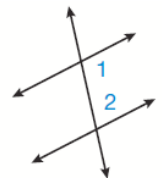
Give one example of each type of angle pair.

3. corresponding angles
4. alternate interior angles
5. alternate exterior angles
6. same-side interior angles
7. Generalize When a transversal intersecting two lines is moved, what happens to the measures of the two angles in a linear pair?

Identify the following in the town map.

8. A street that is a transversal and the streets that it intersects.

9. Two businesses on street corners that represent an alternate exterior angle pair.

10. The angle pair of the street corners with a shopping mall and parking lot.

A transversal may also intersect two parallel lines.

Multi-Step Use the diagram to answer the following questions.

11. What type of angle pair is ∠1 and ∠2?

12. Using a protractor, measure ∠1 and ∠2.

13. What conjecture can you make regarding the measure of a pair of corresponding angles formed when a transversal intersects parallel lines?

When a transversal intersects parallel lines, the angle pairs that are formed are either supplementary or congruent. Postulate 11 and the theorems below indicate which pairs are congruent and which pairs are supplementary.
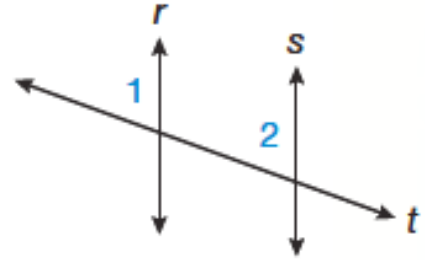
> **Hint**
>
> All of the postulates and theorems presented here refer only to transversals that intersect a pair of parallel lines.

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

Theorem 10-1: Alternate Interior Angles Theorem - If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.

Theorem 10-2: Alternate Exterior Angles Theorem - If two parallel lines are cut by a transversal, then the alternate exterior angles are congruent.

Use the diagram to answer these questions.

14. If m∠1 = 50°, what is m∠2?

15. Write If you know m∠4, is it possible to know m∠2? Explain.
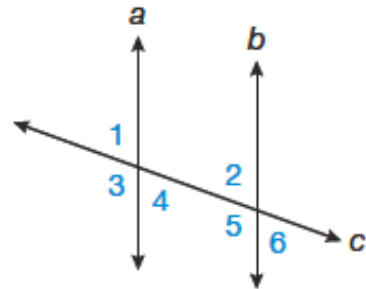
Theorem 10-3: Same-Side Interior Angles Theorem - If two parallel lines are cut by a transversal, then the same-side interior angles are supplementary.

16. If ∠ABC and ∠DEF are a pair of same-side interior angles, what is m∠ABC when m∠DEF = 75°?

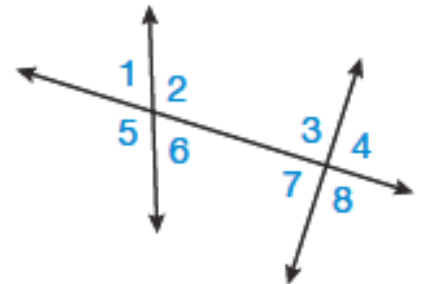17. Multi-Step Lines ℓ and m are intersected by transversal n.
a. What angle pair is represented by the expressions?
b. Find b if ℓ _ m.
c. What is the measure of ∠1?
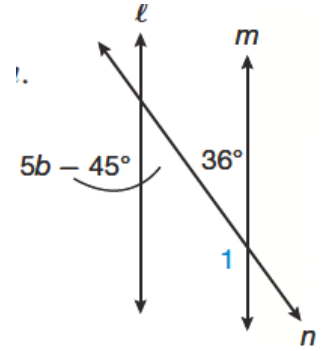
Investigation Practice
What types of angle pairs are the following?
a. ∠5 and ∠4
b. ∠6 and ∠7
c. ∠1 and ∠3
d. ∠1 and ∠8
e. ∠3 and ∠6

Multi-Step Use the diagram to identify the following.
f. A pair of same-side interior angles with transversal b.
g. A pair of corresponding angles with transversal a.
h. A pair of alternate interior angles with transversal c.
i. Identify the transversal such that ∠4 and ∠10 are a pair of alternate exterior angles.
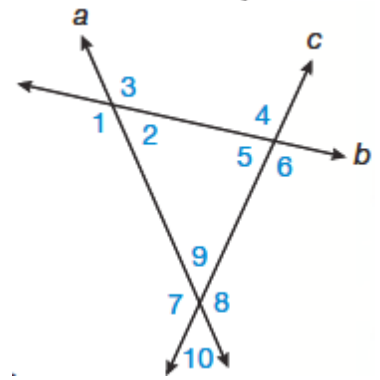
A sign on a hill has posts that are parallel.
j. Identify the components of the diagram that represent a transversal and the two lines it intersects.
k. What is m∠1 if m∠2 = 135°? Justify your answer by naming the theorem used.
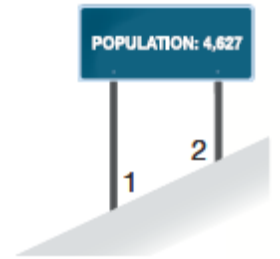
l. Algebra Determine m∠LMP and m∠ONQ when $\overleftrightarrow{MP} \parallel \overleftrightarrow{NQ}$.
m. Analyze: When a transversal intersects two parallel lines, are all the acute angles congruent? Draw a sketch to demonstrate your answer.