

Geometry - Parallel Lines and Transversals - Lesson

Common Core G-CO.C.9 · maths-pdf.fr/en/

When a transversal crosses two parallel lines, corresponding angles and alternate interior angles are congruent, and same-side interior angles add to 180 degrees. Vertical angles are always congruent. The converses also hold, so congruent alternate interior angles prove that two lines are parallel. Every point on a perpendicular bisector is equidistant from the segment's endpoints.

Geometry · Common Core State Standards: **G-CO.C.9**

Key facts

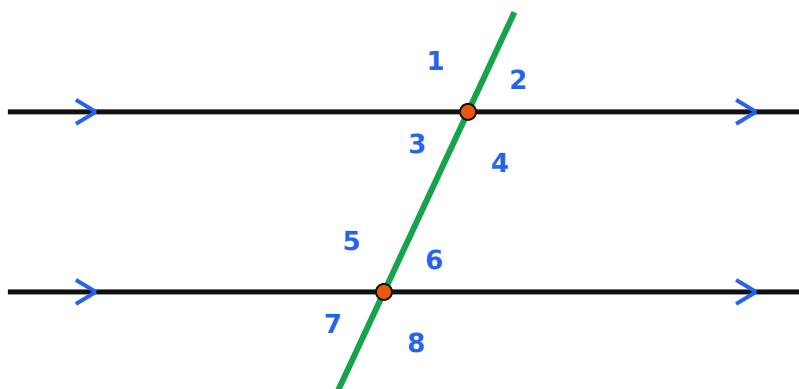
- Vertical angles are congruent, and a linear pair adds to 180 degrees.
- Parallel lines: corresponding and alternate interior angles are congruent.
- Parallel lines: same-side interior angles are supplementary.
- If those angle conditions hold for a transversal, the two lines are parallel.
- Points on the perpendicular bisector of a segment are equidistant from its endpoints.

What are vertical angles and linear pairs?

When two lines cross, they form four angles. **Vertical angles** are opposite each other and are always congruent. Angles next to each other along a line form a **linear pair**, and their measures add to 180° .

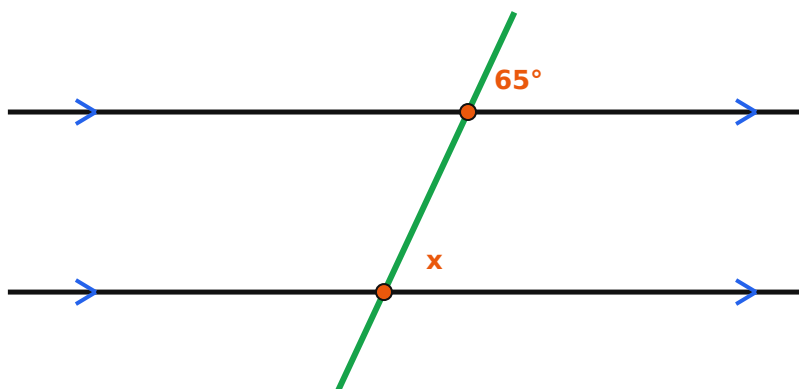
What angles does a transversal make?

A **transversal** is a line that crosses two or more lines in the same plane. When it crosses two lines, it forms eight angles, with special names for pairs.

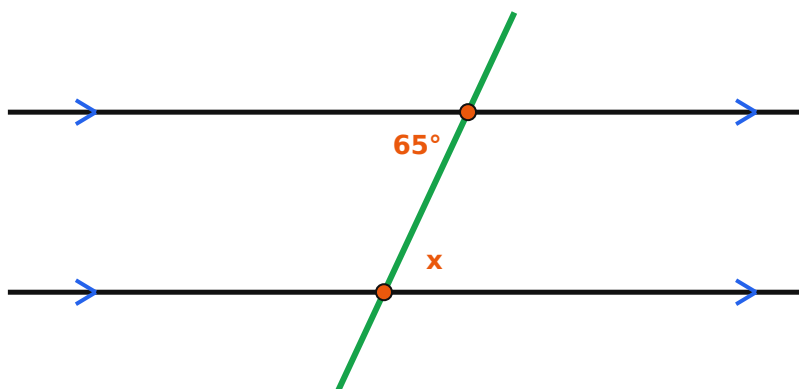


Two parallel lines cut by a transversal form eight angles.

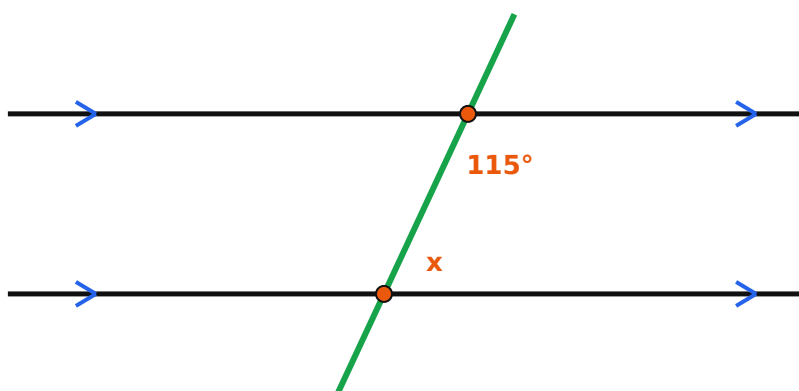
Pair type	Example	If the lines are parallel
Corresponding	2 and 6	congruent
Alternate interior	3 and 6	congruent
Alternate exterior	1 and 8	congruent
Same-side interior	4 and 6	supplementary (sum 180°)



Corresponding angles are congruent when the lines are parallel.



Alternate interior angles are congruent.

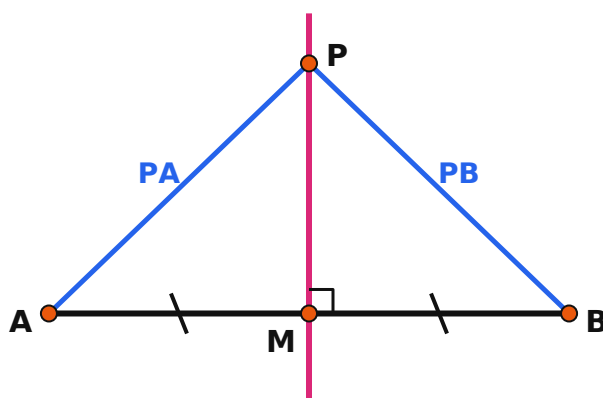


Same-side interior angles add to 180 degrees.

The converse is also true. If a transversal makes a pair of corresponding angles congruent, or a pair of alternate interior angles congruent, or a pair of same-side interior angles supplementary, then the two lines are parallel.

What is a perpendicular bisector?

The **perpendicular bisector** of a segment passes through its midpoint at a right angle. Every point on it is the same distance from both endpoints, and every point that is equally far from both endpoints lies on it.



Every point on the perpendicular bisector of AB is equally far from A and from B.

How do you find an unknown angle?

1. Identify the relationship: vertical, linear pair, corresponding, alternate interior or same-side interior.
2. Decide whether the angles are equal or add to 180° .
3. Write an equation and solve for the variable.
4. Substitute back and check.

Example: Parallel lines are cut by a transversal. Alternate interior angles measure $(4x-7)^\circ$ and $(2x+25)^\circ$. Then $4x-7=2x+25$, so $x=16$ and each angle is 57° .

Questions about parallel lines and transversals

What is a transversal?

A transversal is a line that intersects two or more other lines at different points. When it crosses two lines it forms eight angles.

Are alternate interior angles always congruent?

Only when the two lines crossed by the transversal are parallel. If the angles are congruent, that proves the lines are parallel.

How do you tell same-side interior angles from alternate interior angles?

Both pairs lie between the two lines. Same-side interior angles are on the same side of the transversal; alternate interior angles are on opposite sides.

Why are vertical angles congruent?

Each of the two vertical angles forms a linear pair with the same third angle. Both equal 180 degrees minus that angle, so they are equal.

What does the perpendicular bisector theorem say?

Any point on the perpendicular bisector of a segment is the same distance from both endpoints. For example, a point 13 units from one end is also 13 units from the other.