

Parallel Lines Cut by a Transversal

Grade 10 – Geometry math · Worksheet · Standards: G-CO.C.9

Name: _____ Date: _____ Class: _____

These problems cover the angle pairs formed by a transversal, the theorems for parallel lines, their converses and the Perpendicular Bisector Theorem, all under standard G-CO.C.9. Early problems name pairs and find angles. Later problems use algebra, test whether lines are parallel and ask for two-column proofs.

Standards: G-CO.C.9 · **Level:** Grade 10 Geometry

Problem 1 Name the angle pairs (easy)

Lines a and b are cut by transversal t . Classify each pair as corresponding, alternate interior, alternate exterior or same-side interior.

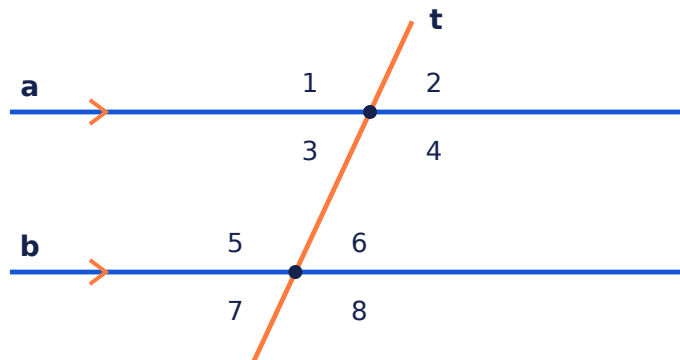


Figure for Problem 1.

- a. $\angle 3$ and $\angle 6$
- b. $\angle 1$ and $\angle 5$
- c. $\angle 4$ and $\angle 6$
- d. $\angle 2$ and $\angle 7$

Problem 2 Alternate interior and same-side (easy)

Lines a and b are parallel and $m\angle 3 = 74^\circ$. Find $m\angle 6$ and $m\angle 5$.

Problem 3 Same-side interior angles (easy)

Lines a and b are parallel and $m\angle 4 = 127^\circ$. Find $m\angle 6$.

Problem 4 Alternate exterior angles (easy)

Lines a and b are parallel and $m\angle 1 = 133^\circ$. Find $m\angle 8$ and $m\angle 7$.

Problem 5 Corresponding angles with algebra (medium)

Lines a and b are parallel. Corresponding angles $\angle 1$ and $\angle 5$ measure $(7x - 8)^\circ$ and $(4x + 37)^\circ$. Find x and each angle.

Problem 6 Same-side interior with algebra (medium)

Lines a and b are parallel. Same-side interior angles measure $(4x + 12)^\circ$ and $(6x - 2)^\circ$. Find x and both angles.

Problem 7 Alternate interior with algebra (medium)

Lines a and b are parallel. Alternate interior angles measure $(2x + 31)^\circ$ and $(5x - 17)^\circ$. Find x and their measure.

Problem 8 All eight angles (medium)

Lines a and b are parallel, and $m\angle 6 = 49^\circ$. Find the measure of every other numbered angle.

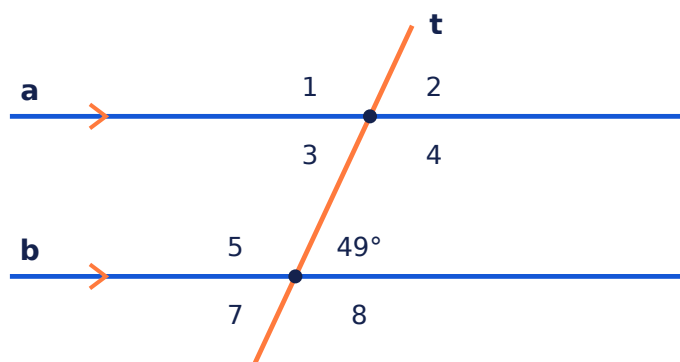


Figure for Problem 8.

Problem 9 Are the lines parallel (medium)

A transversal crosses lines m and n . Decide whether the lines must be parallel and name the converse used.

- Corresponding angles measure 83° and 83° .
- Same-side interior angles measure 98° and 92° .

c. Alternate exterior angles measure 117° and 117° .

Problem 10 Value of x for parallel lines (medium)

A transversal crosses lines m and n . Corresponding angles measure $(5x + 4)^\circ$ and $(7x - 26)^\circ$. Find x so that $m \parallel n$, and give the angle measure.

Problem 11 Same-side interior converse (medium)

A transversal crosses lines m and n . Same-side interior angles measure $(6x + 7)^\circ$ and $(4x + 13)^\circ$. Find x so that $m \parallel n$.

Problem 12 Perpendicular bisector equation (medium)

Point P lies on the perpendicular bisector of AB . $PA = 5x - 14$ and $PB = 3x + 10$. Find x and PA .

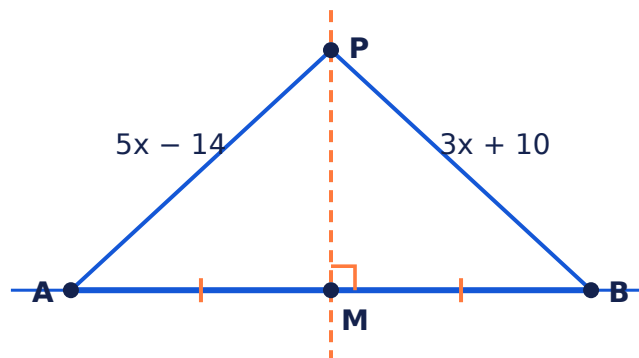
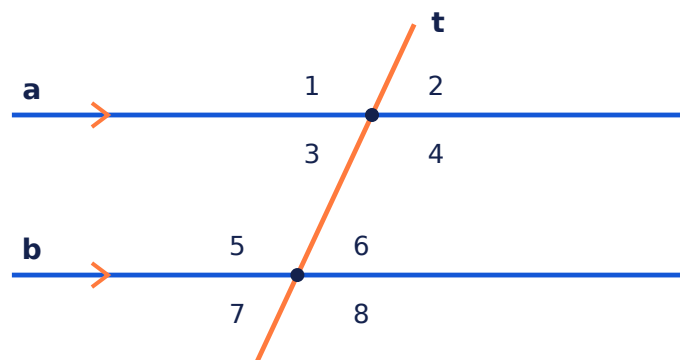


Figure for Problem 12.

Problem 13 Alternate interior proof (medium)

Given: $a \parallel b$. Prove: $\angle 3 \cong \angle 6$. Complete a two-column proof using the figure with angles numbered as in Problem 1.



Problem 14 Prove lines parallel (medium)

Given: $\angle 4$ and $\angle 6$ are supplementary. Prove: $a \parallel b$. Use the angle numbering of Problem 1 and write a two-column proof.

Problem 15 Crossing streets (hard)

Maple Street and Oak Street are parallel, and Pine Avenue crosses both. At Maple, the angle between the north part of Pine and the east part of Maple is 71° . Find (a) the angle between the north part of Pine and the east part of Oak, (b) the angle between the north part of Pine and the west part of Oak, (c) the angle at Maple between the south part of Pine and the west part of Maple.

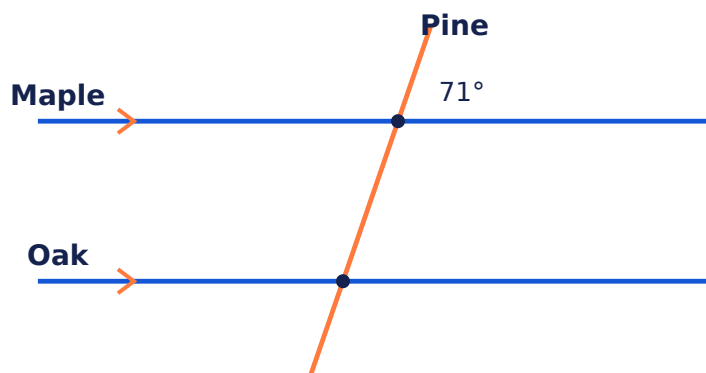


Figure for Problem 15.

Problem 16 Equidistant lamp post (hard)

A park designer places lamp post L on the perpendicular bisector of the segment joining bench B and fountain F , which are 40 feet apart. The distances are $LB = (3x + 8)$ ft and $LF = (5x - 6)$ ft. Find x , LB , and the distance from the lamp post to the midpoint of BF .

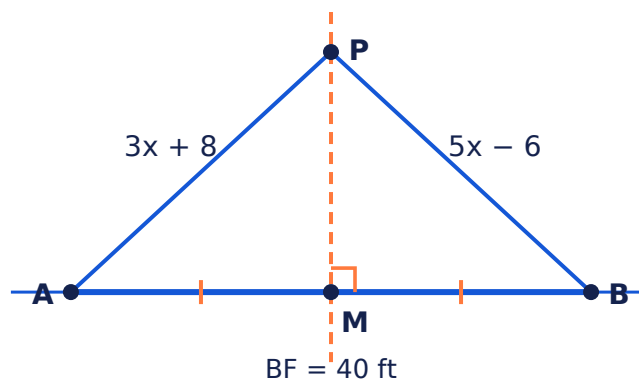


Figure for Problem 16 (not to scale).

Problem 17 Same-side exterior angles (hard)

Lines a and b are parallel. $\angle 1$ measures $(8x + 4)^\circ$ and $\angle 7$ measures $(4x + 8)^\circ$, using the numbering of Problem 1. These angles are on the outside of the lines and on the same side of the transversal. Find x and both angles.

Problem 18 Bisecting an angle between parallels (hard)

Lines a and b are parallel. $\angle 3$ measures $(5x + 3)^\circ$ and its alternate interior partner $\angle 6$ measures $(7x - 25)^\circ$. A ray bisects $\angle 4$. Find x , $m\angle 4$, and the measure of each half of $\angle 4$.

Problem 19 Supplementary angles proof (hard)

Given: $a \parallel b$. Prove: $\angle 1$ and $\angle 6$ are supplementary. Use the angle numbering of Problem 1 and write a two-column proof.

Problem 20 Prove the bisector theorem (hard)

Line ℓ is the perpendicular bisector of AB at midpoint M , and P is a point on ℓ . Prove that $PA = PB$, then check it with $A(-6, 0)$, $B(6, 0)$ and $P(0, 8)$.