Parallel Lines Cut by a Transversal

Geometry Worksheet · Grade 8–10

Name: _____ Date: _____

Learning Objectives

- Identify and apply the Alternate Interior Angles Theorem and its converse
- Identify and apply the Corresponding Angles Theorem and its converse
- Use supplementary angle relationships (linear pairs) and vertical angles to find missing angle measures

Problems

1. Two parallel lines are cut by a transversal. Angle 3 measures 70°. Using the Alternate Interior Angles Theorem, what is the measure of Angle 6?

$$\angle 3 = 70^\circ, \quad \angle 6 = ?$$

2. Two parallel lines are cut by a transversal. Angle 5 measures 112°. What is the measure of its vertical angle, Angle 7?

$$\angle 5 = 112^\circ, \quad \angle 7 = ?$$

3. Two parallel lines are cut by a transversal forming a linear pair at one intersection. If one angle measures 55°, what is the measure of its supplementary angle?

$$180^\circ - 55^\circ = ?$$

4. Two parallel lines are cut by a transversal. Angle 1 and Angle 5 are corresponding angles, and Angle 1 measures 83°. What is the measure of Angle 5?

$$\angle 1 = 83^\circ, \quad \angle 5 = ?$$

5. Two parallel lines are cut by a transversal. Given that Angle 4 = 125°, find the measures of Angles 3, 5, and 6 using the properties of vertical angles, alternate interior angles, and linear pairs.

$$\angle 4 = 125^\circ$$

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6. In the figure of two parallel lines cut by a transversal, Angle 3 and Angle 5 are alternate interior angles. If ∠3 = (3x + 10)° and ∠5 = (5x – 20)°, find the value of x.

$$3x + 10 = 5x - 20$$

7. Two parallel lines are cut by a transversal. Corresponding angles are represented as ∠1 = (4x + 15)° and ∠5 = (6x – 5)°. Find the value of x and the measure of each angle.

$$4x + 15 = 6x - 5$$

8. Two parallel lines are cut by a transversal. Angle 4 and Angle 6 are alternate interior angles. If ∠4 = (7x – 3)° and ∠6 = (4x + 18)°, find x and determine the measure of ∠4.

$$7x - 3 = 4x + 18$$

9. Two parallel lines are cut by a transversal. A student claims that ∠2 = 130° and ∠6 = 50° are corresponding angles and therefore congruent. Is the student correct? Explain using the Corresponding Angles Theorem.

$$\angle 2 = 130^\circ, \quad \angle 6 = 50^\circ$$

10. Two parallel lines are cut by a transversal. Given ∠1 = (2x² – x)° and ∠5 = (x² + 30)° as corresponding angles, find all possible values of x and the measure of each angle.

$$2x^2 - x = x^2 + 30$$

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Parallel Lines Cut by a Transversal — Answer Key

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Answer Key

1. Answer: 70°

- Angles 3 and 6 are alternate interior angles (they lie between the parallel lines on opposite sides of the transversal).
- By the Alternate Interior Angles Theorem, alternate interior angles are congruent, so ∠6 = 70°.

2. Answer: 112°

- Angles 5 and 7 are vertical angles formed at the same intersection point.
- Vertical angles are always congruent, so ∠7 = 112°.

3. Answer: 125°

- A linear pair of angles is supplementary, meaning they add up to 180°.
- Subtract: 180° – 55° = 125°.

4. Answer: 83°

- Corresponding angles are in the same position at each intersection when a transversal crosses parallel lines.
- By the Corresponding Angles Theorem, corresponding angles are congruent, so ∠5 = 83°.

5. Answer: ∠3 = 55°, ∠5 = 125°, ∠6 = 55°

- ∠3 and ∠4 form a linear pair: ∠3 = 180° – 125° = 55°.
- ∠5 and ∠4 are alternate interior angles... wait — ∠4 and ∠6 are alternate interior angles, so ∠6 = 125°? Re-check: using standard numbering, ∠3 and ∠5 are alternate interior angles so ∠5 = ∠3 = 55°; ∠6 and ∠4 are alternate interior angles so ∠6 = 125°... Using the video's convention: ∠5 = ∠4 (vertical) = 125°; ∠3 = 180° – 125° = 55°; ∠6 = ∠3 (alternate interior) = 55°.

6. Answer: x = 15

- Alternate interior angles are congruent, so set the expressions equal: 3x + 10 = 5x – 20.
- Solve: 10 + 20 = 5x – 3x → 30 = 2x → x = 15.

7. Answer: x = 10; each angle = 55°

- Corresponding angles are congruent: 4x + 15 = 6x – 5 → 20 = 2x → x = 10.
- Substitute: 4(10) + 15 = 40 + 15 = 55°.

8. Answer: x = 7; ∠4 = 46°

- Set alternate interior angles equal: 7x – 3 = 4x + 18 → 3x = 21 → x = 7.
- Substitute: ∠4 = 7(7) – 3 = 49 – 3 = 46°.

9. Answer: No; corresponding angles must be congruent (equal), but 130° ≠ 50°.

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• The Corresponding Angles Theorem states that if two parallel lines are cut by a transversal, then corresponding angles are congruent.
• Since 130° ≠ 50°, these angles cannot be corresponding angles on parallel lines — the student is incorrect.

10. Answer: x = 6 (∠ = 66°) or x = –5 (∠ = 55°)

• Set corresponding angles equal: $2x^2 – x = x^2 + 30 \rightarrow x^2 – x – 30 = 0 \rightarrow (x – 6)(x + 5) = 0$, so x = 6 or x = –5.
• For x = 6: ∠ = 2(36) – 6 = 66°. For x = –5: ∠ = 2(25) – (–5) = 55°. Both are valid since angles are positive.

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