Writing Two-Column Proofs in Geometry

Geometry Worksheet · Grade 8–10

Name: _____ Date: _____

Learning Objectives

- Identify and apply properties of equality (addition, subtraction, multiplication, division) as reasons in a two-column proof
- Organize logical statements and corresponding justifications in a two-column proof format
- Apply reflexive, symmetric, transitive, substitution, and distributive properties to justify steps in algebraic and geometric proofs

Problems

1. Complete the two-column proof: Given 3x = 12, state the reason that justifies the step x = 4.

$$3x = 12 \Rightarrow x = 4$$

2. Complete the two-column proof: Given x + 9 = 15, state the reason that justifies the step x = 6.

$$x + 9 = 15 \Rightarrow x = 6$$

3. Complete the two-column proof: Given \frac{x}{4} = 5, state the reason that justifies the step x = 20.

$$\frac{x}{4} = 5 \Rightarrow x = 20$$

4. Write a two-column proof for 5x + 12 = 47 to show that x = 7, naming the reason for each step.

$$5x + 12 = 47$$

5. Complete the two-column proof: Given that segment AB \cong segment AB, identify the property used.

$$AB \cong AB$$

6. Complete the two-column proof: Given that if AB = CD and CD = EF, state the property that justifies AB = EF.

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$$AB = CD,\ CD = EF \Rightarrow AB = EF$$

7. Write a two-column proof for 2(x + 5) = 18 to solve for x, naming the reason for each step.

$$2(x + 5) = 18$$

8. Write a two-column proof showing that if m\angle A = m\angle B and m\angle B = 45°, then m\angle A = 45°, stating all reasons.

$$m\angle A = m\angle B,\ m\angle B = 45°$$

9. Write a complete five-step two-column proof for 7x - 10(5 + 3x) = 20 - 2x to solve for x, naming every reason.

$$7x - 10(5 + 3x) = 20 - 2x$$

10. Write a two-column proof: Given that \angle 1 and \angle 2 are supplementary and m\angle 1 = 3x + 10, m\angle 2 = x + 30, prove that x = 35.

$$m\angle 1 + m\angle 2 = 180°,\ m\angle 1 = 3x + 10,\ m\angle 2 = x + 30$$

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Writing Two-Column Proofs in Geometry — Answer Key

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Answer Key

1. Answer: Division Property of Equality
- Statement 1: 3x = 12 — Reason: Given
- Statement 2: x = 4 — Reason: Division Property of Equality (divide both sides by 3)

2. Answer: Subtraction Property of Equality
- Statement 1: x + 9 = 15 — Reason: Given
- Statement 2: x = 6 — Reason: Subtraction Property of Equality (subtract 9 from both sides)

3. Answer: Multiplication Property of Equality
- Statement 1: \frac{x}{4} = 5 — Reason: Given
- Statement 2: x = 20 — Reason: Multiplication Property of Equality (multiply both sides by 4)

4. Answer: x = 7; Reasons: Given, Subtraction Property of Equality, Division Property of Equality
- Statement 1: 5x + 12 = 47 — Reason: Given
- Statement 2: 5x = 35 — Reason: Subtraction Property of Equality (subtract 12 from both sides)
- Statement 3: x = 7 — Reason: Division Property of Equality (divide both sides by 5)

5. Answer: Reflexive Property of Congruence
- Statement 1: AB \cong AB — Reason: Reflexive Property of Congruence
- Any segment (or angle) is congruent to itself by the Reflexive Property

6. Answer: Transitive Property of Equality
- Statement 1: AB = CD — Reason: Given
- Statement 2: CD = EF — Reason: Given
- Statement 3: AB = EF — Reason: Transitive Property of Equality

7. Answer: x = 4; Reasons: Given, Distributive Property, Subtraction Property of Equality, Division Property of Equality
- Statement 1: 2(x + 5) = 18 — Reason: Given
- Statement 2: 2x + 10 = 18 — Reason: Distributive Property
- Statement 3: 2x = 8 — Reason: Subtraction Property of Equality (subtract 10)
- Statement 4: x = 4 — Reason: Division Property of Equality (divide by 2)

8. Answer: m∠A = 45°; Reason: Substitution Property of Equality
- Statement 1: m∠A = m∠B — Reason: Given
- Statement 2: m∠B = 45° — Reason: Given
- Statement 3: m∠A = 45° — Reason: Substitution Property of Equality (substitute m∠B = 45° into Statement 1)

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9. Answer: x = -\frac{30}{21} = -\frac{10}{7}; Reasons: Given, Distributive Property, Combine Like Terms, Addition Property of Equality, Division Property of Equality

- Statement 1: 7x - 10(5 + 3x) = 20 - 2x — Reason: Given
- Statement 2: 7x - 50 - 30x = 20 - 2x — Reason: Distributive Property
- Statement 3: -23x - 50 = 20 - 2x — Reason: Combine Like Terms
- Statement 4: -21x = 70 — Reason: Addition Property of Equality (add 2x and 50 to both sides)
- Statement 5: x = -\frac{10}{3} — Reason: Division Property of Equality (divide both sides by -21)

10. Answer: x = 35; Reasons: Definition of Supplementary Angles, Substitution, Combine Like Terms, Subtraction Property of Equality, Division Property of Equality

- Statement 1: ∠1 and ∠2 are supplementary; m∠1 = 3x+10, m∠2 = x+30 — Reason: Given
- Statement 2: m∠1 + m∠2 = 180° — Reason: Definition of Supplementary Angles
- Statement 3: (3x + 10) + (x + 30) = 180° — Reason: Substitution Property of Equality
- Statement 4: 4x + 40 = 180° — Reason: Combine Like Terms
- Statement 5: 4x = 140 — Reason: Subtraction Property of Equality (subtract 40)
- Statement 6: x = 35 — Reason: Division Property of Equality (divide by 4)

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