🔷 Class 7 Geometry Worksheet by Thinking Juggernaut🔷

Triangles, Congruence, Parallel Lines & Constructions

⏱️ Time: 90 minutes | 📊 Total: 24 Questions | 💯 Marks: 48

📋 Instructions for Students

- Read each question carefully before solving
- Show all your work and steps clearly
- Use a ruler and compass for construction problems
- Draw neat diagrams where required
- Write units in your final answers
- Check your answers after completing all questions

🎯 Essential Formulas & Properties

Triangle Properties:

- Sum of angles = 180°
- Exterior angle = Sum of two opposite interior angles
- Sum of any two sides > Third side

Congruence Criteria:

- SSS: Side-Side-Side
- SAS: Side-Angle-Side
- ASA: Angle-Side-Angle
- RHS: Right angle-Hypotenuse-Side

Parallel Lines:

- Corresponding angles are equal
- Alternate interior angles are equal

- Co-interior angles sum to 180°

Section A: Angles and Triangle Properties (8 Questions - 2 marks each)

Easy Level

Q1. In a triangle ABC, ∠A = 65° and ∠B = 45°. Find ∠C.

Q2. The angles of a triangle are in the ratio 2:3:4. Find all three angles.

Q3. In triangle PQR, the exterior angle at Q is 125°. If ∠P = 60°, find ∠R.

Q4. Two angles of a triangle are 70° and 80°. Is this triangle acute, obtuse, or right-angled? Justify your answer.

Q5. If two parallel lines are cut by a transversal, and one of the corresponding angles is 115°, find the other corresponding angle.

Q6. Two parallel lines are cut by a transversal. If one of the alternate interior angles is 68°, what is the value of the other alternate interior angle?

Q7. The sides of a triangle are 7 cm, 24 cm, and 25 cm. Check if this forms a right-angled triangle using Pythagoras theorem.

Q8. In triangle DEF, DE = 8 cm, EF = 6 cm. What is the range of possible values for the third side DF?

Section B: Congruence of Triangles (8 Questions - 2 marks each)

Medium Level

Q9. In triangles ABC and DEF, AB = DE = 5 cm, BC = EF = 6 cm, and AC = DF = 7 cm. Are the triangles congruent? If yes, by which criterion?

Q10. In triangles PQR and XYZ, PQ = XY, ∠Q = ∠Y, and QR = YZ. State the congruence criterion that proves △PQR ≅ △XYZ.

Q11. Two right triangles have equal hypotenuses and one equal side. Are they congruent? Name the criterion.

Q12. In triangle ABC, AB = AC. If ∠B = 55°, find ∠C. What type of triangle is this?

Q13. In the given figure (imagine), AD is the median of triangle ABC. If AB = AC, prove that AD ⊥ BC. Which congruence criterion would you use?

Q14. State whether the following pairs of triangles are congruent. Give reasons:
△ABC: AB = 4 cm, ∠A = 60°, AC = 5 cm
△PQR: PQ = 4 cm, ∠P = 60°, PR = 5 cm

Q15. In triangles ABC and DEF, ∠A = ∠D = 90°, AB = DE, and BC = EF. Are the triangles congruent? State the criterion.

Q16. If in triangle ABC, AB = AC and the altitude from A to BC bisects BC at D, prove that $\triangle ABD \cong \triangle ACD$.

Section C: Advanced Problems (8 Questions - 2 marks each)

Challenge Level

Q17. Two parallel lines l and m are cut by a transversal t. If the co-interior angles are $(3x + 20)^\circ$ and $(2x + 10)^\circ$, find the value of x and both angles.

Q18. In triangle ABC, the bisector of $\angle A$ meets BC at D. If $\angle B = 60^\circ$ and $\angle C = 50^\circ$, find $\angle BAD$ and $\angle CAD$.

Q19. The angles of a quadrilateral are in the ratio 3:4:5:6. Find all four angles. (Hint: Sum of angles in quadrilateral = 360°)

Q20. In an isosceles triangle, if the vertex angle is 40°, find the base angles.

Q21. A ladder 25 m long reaches a window 24 m above the ground. How far is the foot of the ladder from the base of the wall? (Use Pythagoras theorem)

Q22. In triangle PQR, PQ = PR = 10 cm and QR = 12 cm. Find the altitude from P to QR.

Q23. Two lines AB and CD intersect at O. If ∠AOC = 3x + 20° and ∠BOD = 5x - 40°, find x and all four angles. (Remember: Vertically opposite angles are equal)

Q24. In a triangle ABC, ∠A = 90°, AB = 12 cm, and AC = 5 cm. A perpendicular from A meets BC at D. If BD = 9.6 cm, find the length of AD.

💡 Worked Example: Congruence Problem

Problem: In triangles ABC and PQR, AB = PQ = 7 cm, ∠B = ∠Q = 70°, and BC = QR = 8 cm. Prove that the triangles are congruent.

Solution:

Given:

- AB = PQ = 7 cm
- ∠B = ∠Q = 70°
- BC = QR = 8 cm

In △ABC and △PQR:

- AB = PQ (given)
- ∠B = ∠Q (given)
- BC = QR (given)

Therefore, △ABC ≅ △PQR by SAS (Side-Angle-Side) criterion.

📊 Scoring Guide

Total Marks: 48

- Excellent: 40-48 marks (Outstanding understanding!)
- Very Good: 32-39 marks (Keep up the great work!)
- Good: 24-31 marks (You're doing well!)
- Need Practice: Below 24 marks (Review concepts and try again!)

🔑 Answer Key with Detailed Solutions

Section A: Angles and Triangle Properties

A1. ∠C = 70°

Solution: Sum of angles in a triangle = 180°

∠A + ∠B + ∠C = 180°

65° + 45° + ∠C = 180°

∠C = 180° - 110° = 70°

A2. Angles are 40°, 60°, and 80°

Solution: Let angles be 2x, 3x, and 4x

2x + 3x + 4x = 180°

9x = 180°

x = 20°
Therefore: 2x = 40°, 3x = 60°, 4x = 80°

A3. **∠R = 65°**
Solution: Exterior angle = Sum of opposite interior angles
125° = ∠P + ∠R
125° = 60° + ∠R
∠R = 65°

A4. **Acute triangle**
Solution: Third angle = 180° - (70° + 80°) = 30°
All three angles (70°, 80°, 30°) are less than 90°, so it's an acute triangle.

A5. **115°**
Solution: Corresponding angles are equal when parallel lines are cut by a transversal.

A6. **68°**
Solution: Alternate interior angles are equal when parallel lines are cut by a transversal.

A7. **Yes, it's a right-angled triangle**
Solution: Check if $7^2 + 24^2 = 25^2$
49 + 576 = 625
625 = 625 ✓
Since Pythagoras theorem is satisfied, it's a right-angled triangle.

A8. **2 cm < DF < 14 cm**
Solution: Triangle inequality: Difference of two sides < Third side < Sum of two sides
8 - 6 < DF < 8 + 6
2 < DF < 14

Section B: Congruence of Triangles

A9. **Yes, congruent by SSS criterion**
Solution: All three sides are equal (AB = DE, BC = EF, AC = DF), so triangles are congruent by SSS.

A10. **SAS (Side-Angle-Side) criterion**
Solution: Two sides and the included angle are equal.

A11. Yes, by RHS criterion
Solution: In right triangles, if hypotenuse and one side are equal, they're congruent by RHS (Right angle-Hypotenuse-Side).

A12. ∠C = 55°; Isosceles triangle
Solution: Since AB = AC, angles opposite to equal sides are equal.
Therefore, ∠B = ∠C = 55°
This is an isosceles triangle.

A13. Use SAS criterion
Solution: In △ABD and △ACD:
AB = AC (given)
BD = CD (AD is median)
AD = AD (common)
Therefore △ABD ≅ △ACD by SSS
So ∠ADB = ∠ADC, and since they're supplementary, each = 90°

A14. Yes, congruent by SAS criterion
Solution: AB = PQ = 4 cm, ∠A = ∠P = 60°, AC = PR = 5 cm
Two sides and included angle are equal.

A15. Yes, by RHS criterion
Solution: Both triangles are right-angled (∠A = ∠D = 90°)
Hypotenuse BC = EF
One side AB = DE
Therefore, congruent by RHS.

A16. Proof using SAS:
Solution: In △ABD and △ACD:
AB = AC (given)
AD = AD (common)
∠ADB = ∠ADC = 90° (altitude)
Therefore △ABD ≅ △ACD by RHS or SAS.

Section C: Advanced Problems

A17. x = 30°; Angles are 110° and 70°
Solution: Co-interior angles sum to 180°
(3x + 20°) + (2x + 10°) = 180°

$5x + 30° = 180°$
$5x = 150°$
$x = 30°$
First angle = $3(30) + 20 = 110°$
Second angle = $2(30) + 10 = 70°$

A18. ∠BAD = 35° and ∠CAD = 35°
Solution: $\angle A = 180° - (60° + 50°) = 70°$
Since AD bisects $\angle A$:
$\angle BAD = \angle CAD = 70°/2 = 35°$

A19. Angles are 60°, 80°, 100°, and 120°
Solution: Let angles be 3x, 4x, 5x, and 6x
$3x + 4x + 5x + 6x = 360°$
$18x = 360°$
$x = 20°$
Angles: 60°, 80°, 100°, 120°

A20. Base angles = 70° each
Solution: In isosceles triangle, base angles are equal
Vertex angle + 2(base angle) = 180°
40° + 2(base angle) = 180°
Base angle = 140°/2 = 70°

A21. 7 m
Solution: Using Pythagoras theorem:
$\text{Ladder}^2 = \text{Height}^2 + \text{Distance}^2$
$25^2 = 24^2 + \text{Distance}^2$
$625 = 576 + \text{Distance}^2$
$\text{Distance}^2 = 49$
Distance = 7 m

A22. Altitude = 8 cm
Solution: In isosceles triangle, altitude bisects the base
Base is divided into two parts of 6 cm each
Using Pythagoras theorem in one half:
$10^2 = h^2 + 6^2$
$100 = h^2 + 36$

$h^2 = 64$
$h = 8$ cm

A23. x = 30°; Angles are 110°, 70°, 110°, 70°
Solution: Vertically opposite angles are equal
$\angle AOC = \angle BOD$
$3x + 20° = 5x - 40°$
$60° = 2x$
$x = 30°$
$\angle AOC = \angle BOD = 3(30) + 20 = 110°$
$\angle AOD = \angle BOC = 180° - 110° = 70°$

A24. AD = 7.2 cm
Solution: First find BC using Pythagoras:
$BC^2 = AB^2 + AC^2 = 12^2 + 5^2 = 144 + 25 = 169$
$BC = 13$ cm
Area of triangle = $\frac{1}{2} \times AB \times AC = \frac{1}{2} \times 12 \times 5 = 30$ cm^2
Also, Area = $\frac{1}{2} \times BC \times AD$
$30 = \frac{1}{2} \times 13 \times AD$
$AD = 60/13 \approx 4.62$ cm
Or using similar triangles: $AD = (AB \times AC)/BC = (12 \times 5)/13 = 60/13 \approx 4.62$ cm

📚 Study Tips for Geometry Success

- **Master the Basics:** Understand all angle properties and triangle properties thoroughly before moving to advanced topics
- **Practice Constructions:** Regular practice with compass and ruler improves accuracy and understanding
- **Draw Diagrams:** Always draw neat, labeled diagrams - they make problems much easier
- **Learn Congruence Criteria:** Memorize SSS, SAS, ASA, and RHS - know when to use each one
- **Understand Proofs:** Don't just memorize steps - understand the logical flow of geometric proofs
- **Common Pitfalls:**
  - Don't confuse corresponding angles with alternate angles

- Remember that exterior angle equals sum of opposite interior angles, not all angles
- In congruence, order of vertices matters
- Check triangle inequality before assuming three sides can form a triangle

- **Problem-Solving Tips:**
  - For parallel lines: Look for corresponding, alternate, or co-interior angles
  - For triangles: Start by finding the sum of angles = 180°
  - For isosceles triangles: Remember base angles are equal
  - For word problems: Draw and label the diagram first
  - Use Pythagoras theorem when you see right angles
- **Real-World Applications:** Look for triangular structures, parallel lines in architecture, and geometric patterns around you

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✨ **Excellent Work Completing This Worksheet!** ✨

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