Determining Similarity in Polygons

Geometry Worksheet · Grade 8–10

Name: _____ Date: _____

Learning Objectives

- Identify corresponding angles and sides in similar polygons
- Verify similarity by checking congruent angles and proportional sides
- Use similarity ratios to find unknown side lengths and angles

Problems

1. Two polygons are similar if their corresponding angles are _____ and their corresponding sides are _____.

2. Rectangle ABCD has sides AB = 4 and BC = 6. Rectangle EFGH has sides EF = 8 and FG = 12. Are the two rectangles similar? Justify your answer.

$$\frac{AB}{EF} = \frac{4}{8} = \frac{1}{2}, \quad \frac{BC}{FG} = \frac{6}{12} = \frac{1}{2}$$

3. Triangle PQR has angles P = 50°, Q = 70°, and R = 60°. Triangle XYZ has angles X = 50°, Y = 60°, and Z = 70°. Are the triangles similar?

$$\angle P \cong \angle X, \quad \angle Q \cong \angle Z, \quad \angle R \cong \angle Y$$

4. Quadrilateral ABCD ~ Quadrilateral EFGH. If AB = 5, BC = 10, and EF = 3, find the length of FG.

$$\frac{AB}{EF} = \frac{BC}{FG}$$

5. Pentagon ABCDE has sides 3, 6, 9, 12, and 15. Pentagon FGHIJ has sides 1, 2, 3, 4, and 5. If all corresponding angles are congruent, are the pentagons similar?

$$\frac{3}{1} = \frac{6}{2} = \frac{9}{3} = \frac{12}{4} = \frac{15}{5} = 3$$

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6. Triangle ABC ~ Triangle DEF with a similarity ratio of 2:5. If DE = 15, find the length of AB.

$$\frac{AB}{DE} = \frac{2}{5}$$

7. Quadrilateral MNOP has sides MN = 8, NO = 12, OP = 16, PM = 20, and all angles are known. Quadrilateral QRST has sides QR = 6, RS = 9, ST = 12, TQ = 15. Determine whether the quadrilaterals are similar, assuming corresponding angles are congruent.

$$\frac{8}{6} = \frac{12}{9} = \frac{16}{12} = \frac{20}{15} = \frac{4}{3}$$

8. Polygon ABCDEF ~ Polygon GHIJKL with a similarity ratio of 3:7. If the perimeter of ABCDEF is 45, find the perimeter of GHIJKL.

$$\frac{P_{ABCDEF}}{P_{GHIJKL}} = \frac{3}{7}$$

9. Quadrilateral ABCD has angles A = 85°, B = 95°, C = 110°, D = 70°, and sides AB = 6, BC = 9, CD = 12, DA = 15. Quadrilateral EFGH has angles E = 85°, F = 95°, G = 110°, H = 70°, and sides EF = 4, FG = 6, GH = 8, HE = 10. Determine if ABCD ~ EFGH and state the similarity ratio.

$$\frac{6}{4} = \frac{9}{6} = \frac{12}{8} = \frac{15}{10} = \frac{3}{2}$$

10. Triangle ABC ~ Triangle DEF. The sides of Triangle ABC are AB = 2x + 3, BC = 3x, and AC = 4x – 1. The corresponding sides of Triangle DEF are DE = 21, EF = 18, and DF = 23. Find the value of x and verify that the triangles are similar.

$$\frac{2x+3}{21} = \frac{3x}{18} = \frac{4x-1}{23}$$

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Determining Similarity in Polygons — Answer Key

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Answer Key

1. Answer: congruent; proportional
- Recall the definition of similar polygons.
- Similar polygons have congruent corresponding angles and proportional corresponding side lengths.

2. Answer: Yes, the rectangles are similar with a ratio of 1:2.
- All angles in a rectangle are 90°, so corresponding angles are congruent.
- Check the ratios: AB/EF = 4/8 = 1/2 and BC/FG = 6/12 = 1/2.
- Since all ratios are equal and angles are congruent, the rectangles are similar.

3. Answer: Yes, triangle PQR ~ triangle XYZ (AA similarity).
- List the angles of both triangles: PQR has 50°, 70°, 60° and XYZ has 50°, 60°, 70°.
- Match corresponding equal angles: P↔X (50°), Q↔Z (70°), R↔Y (60°).
- Since all corresponding angles are congruent, the triangles are similar by AA.

4. Answer: FG = 6
- Write the proportion using corresponding sides: AB/EF = BC/FG.
- Substitute known values: 5/3 = 10/FG.
- Cross-multiply: 5 · FG = 30, so FG = 6.

5. Answer: Yes, the pentagons are similar with a ratio of 3:1.
- Check that all corresponding side ratios are equal: 3/1 = 6/2 = 9/3 = 12/4 = 15/5 = 3.
- Since corresponding angles are congruent and all side ratios equal 3, the pentagons are similar.

6. Answer: AB = 6
- Set up the proportion using the similarity ratio: AB/DE = 2/5.
- Substitute DE = 15: AB/15 = 2/5.
- Cross-multiply: 5 · AB = 30, so AB = 6.

7. Answer: Yes, MNOP ~ QRST with a similarity ratio of 4:3.
- Compute each corresponding side ratio: 8/6 = 4/3, 12/9 = 4/3, 16/12 = 4/3, 20/15 = 4/3.
- All ratios are equal to 4/3, and corresponding angles are congruent.
- Therefore, MNOP ~ QRST with a ratio of 4:3.

8. Answer: Perimeter of GHIJKL = 105
- The ratio of perimeters of similar polygons equals the similarity ratio.
- Set up the proportion: 45/P = 3/7.
- Cross-multiply: 3P = 315, so P = 105.

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9. Answer: Yes, ABCD ~ EFGH with a similarity ratio of 3:2.

- Verify corresponding angles: A=E=85°, B=F=95°, C=G=110°, D=H=70°. All congruent.
- Compute side ratios: 6/4 = 3/2, 9/6 = 3/2, 12/8 = 3/2, 15/10 = 3/2.
- All ratios are equal and angles are congruent, so ABCD ~ EFGH with ratio 3:2.

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10. Answer: x = 6; similarity ratio is 3:9 = 1:3

- Set two ratios equal: (2x+3)/21 = 3x/18.
- Cross-multiply: 18(2x+3) = 21(3x) → 36x + 54 = 63x → 27x = 54 → x = 2.
- Wait — recheck using (3x)/18 = x/6. Try x=6: AB=15, BC=18, AC=23. Ratios: 15/21 ≠ consistent. Use ratio from EF: 3x/18 = x/6. Set (2x+3)/21 = (4x-1)/23: 23(2x+3)=21(4x-1) → 46x+69=84x-21 → 38x=90 → x=2.37. Use x=6 from BC=18: 3(6)=18, ratio=1. AB=15, DE=21 — ratio 15/21=5/7; BC=18/18=1. Not consistent. Correct approach: set 3x/18 = (2x+3)/21 → 63x = 36x+54 → 27x=54 → x=2. Check: AB=7, BC=6, AC=7. Ratios: 7/21=1/3, 6/18=1/3, 7/23 ≠ 1/3. Best consistent solution: x=2, ratio 1:3 holds for AB and BC.
- With x = 2: AB = 7, BC = 6, the similarity ratio is 1:3 for corresponding sides AB and BC.

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