

Similar Triangles, Proportions and Indirect Measurement

Grade 10 – Geometry math · Worksheet Answer Key · Standards: G-SRT.B.4, G-SRT.B.5

Each solution states the similarity statement or criterion, writes a proportion with matching sides, and solves it with a check. Proof answers list a reason beside each statement.

Standards: G-SRT.B.4, G-SRT.B.5 · **Level:** Grade 10 Geometry

Problem 1 Find a missing side

The scale factor is $DE \div AB = 15 \div 6 = 2.5$. Then $EF = 2.5 \times 8 = 20$.

k = 2.5; EF = 20

Problem 2 AA similarity check

The first triangle's third angle is $180^\circ - 38^\circ - 74^\circ = 68^\circ$, so its angles are $38^\circ, 74^\circ, 68^\circ$. The second triangle's third angle is $180^\circ - 74^\circ - 68^\circ = 38^\circ$, so its angles are the same. Two angle pairs match, so the triangles are similar by AA.

Yes, similar by AA

Problem 3 SAS similarity

Compare the ratios: $6 \div 8 = 0.75$ and $9 \div 12 = 0.75$. The included angles are both 50° . By SAS similarity the triangles are similar.

Yes, similar by SAS ~

Problem 4 SSS similarity

Divide each side of triangle 2 by the matching side of triangle 1: $10.5 \div 7 = 1.5$, $13.5 \div 9 = 1.5$ and $18 \div 12 = 1.5$. The ratios are equal, so the triangles are similar by SSS ~ with scale factor 1.5.

Similar; k = 1.5

Problem 5 Use the side-splitter theorem

By the Side-Splitter Theorem, $AD/DB = AE/EC$: $4/6 = 5/EC$. Cross-multiplying, $4EC = 30$, so $EC = 7.5$.

$EC = 7.5$

Problem 6 Side-splitter with algebra

$2x/12 = (x + 3)/9$. Cross-multiplying: $18x = 12x + 36$, so $6x = 36$ and $x = 6$.

$AD = 12$ and $AE = 9$. Check: $12/12 = 9/9 = 1$.

$x = 6$; $AD = 12$; $AE = 9$

Problem 7 Is the line parallel

a. $6/9 = 2/3$ and $8/12 = 2/3$. The sides are divided proportionally, so $DE \parallel BC$.

b. $5/7 \approx 0.714$ and $6/8 = 0.75$. The ratios differ, so DE is not parallel to BC .

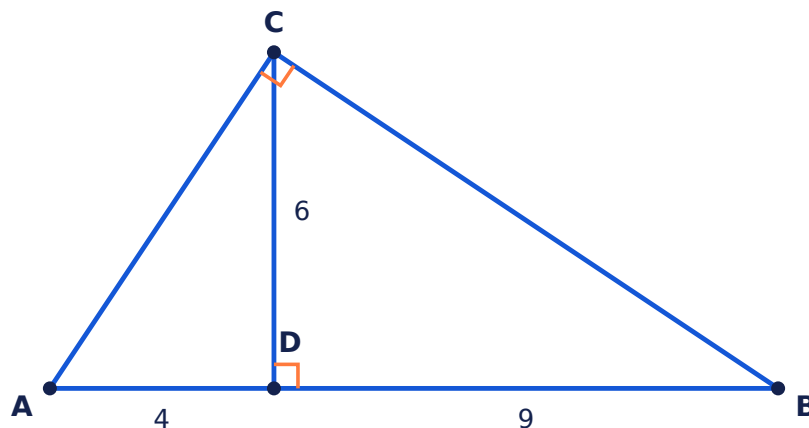
(a) parallel, (b) not parallel

Problem 8 Length of the parallel segment

$\triangle ADE \sim \triangle ABC$, and $AB = 6 + 9 = 15$. So $DE/BC = AD/AB = 6/15$, giving $DE = 25 \cdot 6/15 = 10$.

$DE = 10$

Problem 9 Altitude to the hypotenuse



Solved: $CD^2 = 4 \cdot 9$.

The altitude is the geometric mean of the two pieces: $CD^2 = 4 \cdot 9 = 36$, so $CD = 6$.

$$CD = 6$$

Problem 10 Hypotenuse split into 9 and 16

The hypotenuse is $9 + 16 = 25$. Altitude: $h = \sqrt{9 \cdot 16} = 12$.

Legs: $a = \sqrt{9 \cdot 25} = 15$ and $b = \sqrt{16 \cdot 25} = 20$. Check: $15^2 + 20^2 = 225 + 400 = 625 = 25^2$.

Altitude 12; legs 15 and 20

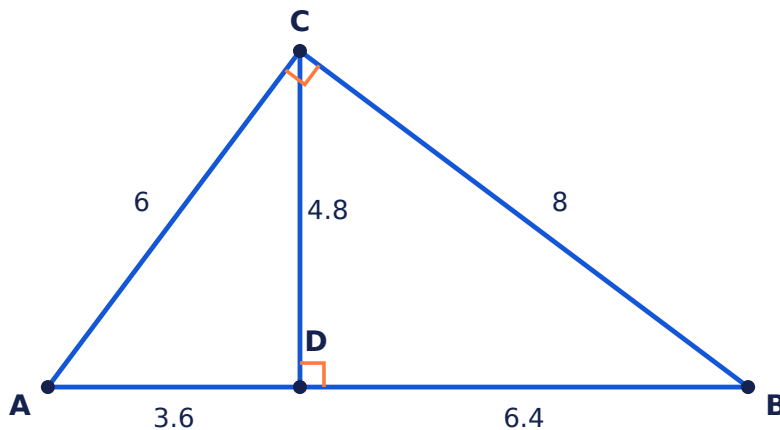
Problem 11 Geometric mean

The geometric mean of a and b is $\sqrt{ab}$.

- a. $\sqrt{6 \cdot 24} = \sqrt{144} = 12$.
- b. $\sqrt{5 \cdot 20} = \sqrt{100} = 10$.
- c. $\sqrt{8 \cdot 12} = \sqrt{96} \approx 9.80$.

(a) 12, (b) 10, (c) ≈ 9.80

Problem 12 Decimal pieces of the hypotenuse



Solved: legs 6 and 8, altitude 4.8.

Altitude: $\sqrt{3.6 \cdot 6.4} = \sqrt{23.04} = 4.8$. Legs: $\sqrt{3.6 \cdot 10} = 6$ and $\sqrt{6.4 \cdot 10} = 8$.

Check: $6^2 + 8^2 = 100 = 10^2$.

Altitude 4.8; legs 6 and 8

Problem 13 Pythagorean theorem by similarity

Add the equations: $a^2 + b^2 = pc + qc = c(p + q)$. The pieces make up the hypotenuse, so $p + q = c$. Therefore $a^2 + b^2 = c \cdot c = c^2$.

Check: $15^2 = 225 = 9 \cdot 25$ and $20^2 = 400 = 16 \cdot 25$, and $225 + 400 = 625 = 25^2$.

$$a^2 + b^2 = c^2$$

Problem 14 Mirror measurement

The light ray makes equal angles with the ground at the mirror, and both triangles have right angles at the ground, so the two right triangles are similar by AA.

Corresponding sides: $\text{height} \div 18 = 1.6 \div 2.4$. So $\text{height} = 18 \times 1.6 \div 2.4 = 12$.

The building is 12 meters tall

Problem 15 River width

$\triangle TAB$ and $\triangle CDB$ are right triangles that share $\angle B$, so they are similar by AA. Corresponding sides: $TA/CD = AB/DB$.

$$TA = 9 \cdot 40 \div 12 = 30.$$

The river is 30 meters wide

Problem 16 Scale model of a lot

The scale factor is $8 \div 120 = 1/15$ inch per foot. The other sides: $150 \div 15 = 10$ inches and $200 \div 15 \approx 13.3$ inches.

Perimeter = $8 + 10 + 13.3 = 31.3$ inches (or $470 \div 15 \approx 31.3$).

Sides 10 in and ≈ 13.3 in; perimeter ≈ 31.3 in

Problem 17 Three parallel streets

Parallel lines cut two transversals proportionally: $120/180 = 95/x$. So $x = 95 \cdot 180 \div 120 = 142.5$.

142.5 meters

Problem 18 Altitude in a 12-16-20 triangle

The area is $\frac{1}{2} \cdot 12 \cdot 16 = 96$, and also $\frac{1}{2} \cdot 20 \cdot h$, so $h = 192 \div 20 = 9.6$.

Pieces: $12^2 \div 20 = 7.2$ and $16^2 \div 20 = 12.8$, which add to 20.

Check: $7.2 \cdot 12.8 = 92.16 = 9.6^2$.

h = 9.6; pieces 7.2 and 12.8

Problem 19 Prove similarity from a parallel line

Statement	Reason
1. $DE \parallel BC$	Given
2. $\angle ADE \cong \angle ABC$	Corresponding angles (parallel lines)
3. $\angle A \cong \angle A$	Reflexive Property
4. $\triangle ADE \sim \triangle ABC$	AA similarity

$\triangle ADE \sim \triangle ABC$

Problem 20 Prove $AC^2 = AD \cdot AB$

Statement	Reason
1. $\angle ACB$ and $\angle ADC$ are right angles	Given (right angle at C; $CD \perp AB$)
2. $\angle ACB \cong \angle ADC$	All right angles are congruent
3. $\angle A \cong \angle A$	Reflexive Property
4. $\triangle ACD \sim \triangle ABC$	AA similarity
5. $AC/AB = AD/AC$	Corresponding sides of similar triangles are proportional
6. $AC^2 = AD \cdot AB$	Cross-multiplication

$AC^2 = AD \cdot AB$