

Geometry · Similar Triangles and Proportions · Worksheet Answer Key

Common Core G-SRT.B.4, G-SRT.B.5 · mathovore.fr

Each solution shows the similarity criterion or theorem used, the proportion, and the final answer in bold. If your answer differs, check that the corresponding sides are matched in the same order in both ratios.

Geometry Common Core: G-SRT.B.4 · G-SRT.B.5

Problem 1: Similar by SSS

Match shortest to shortest, middle to middle, longest to longest: $\frac{EF}{BC} = \frac{9}{6} = \frac{3}{2}$, $\frac{FD}{CA} = \frac{12}{8} = \frac{3}{2}$, $\frac{DE}{AB} = \frac{15}{10} = \frac{3}{2}$.

All three ratios are equal, so the triangles are similar by **SSS**. **Scale factor $\frac{3}{2}$; $ABC \sim DEF$.**

Problem 2: Missing sides

The scale factor is $\frac{DE}{AB} = \frac{9}{6} = \frac{3}{2}$.

$EF = \frac{3}{2} \cdot 8 = 12$ and $DF = \frac{3}{2} \cdot 10 = 15$. **EF = 12, DF = 15.**

Problem 3: Similar by SAS

$\frac{DE}{AB} = \frac{10}{6} = \frac{5}{3}$ and $\frac{DF}{AC} = \frac{15}{9} = \frac{5}{3}$. The sides around the congruent included angles are proportional.

Similar by SAS, $ABC \sim DEF$, scale factor $\frac{5}{3}$.

Problem 4: SSS or not

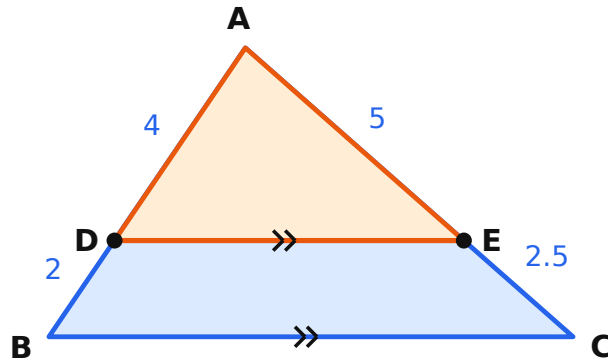
- a. $\frac{6}{4} = \frac{9}{6} = \frac{12}{8} = \frac{3}{2}$: **similar**
- b. $\frac{6}{4} = 1.5$, $\frac{9}{6} = 1.5$, $\frac{13}{8} = 1.625$: the ratios differ, so **not similar**
- c. $\frac{15}{5} = \frac{36}{12} = \frac{39}{13} = 3$: **similar**

Problem 5: Parallel line and AA

Angle A is shared, and $\angle ADE \cong \angle ABC$ because they are corresponding angles for parallel lines. So the triangles are similar by AA.

$AB = 4 + 2 = 6$, and $\frac{AD}{AB} = \frac{AE}{AC}$ gives $\frac{4}{6} = \frac{5}{AC}$, so $AC = 7.5$.

$$EC = 7.5 - 5 = 2.5. \text{ AC} = 7.5 \text{ and EC} = 2.5.$$



Triangle ADE (orange) is similar to triangle ABC.

Problem 6: Side-splitter: find EC

$$\frac{AD}{DB} = \frac{AE}{EC} \text{ gives } \frac{6}{9} = \frac{8}{x}.$$

Cross-multiply: $6x = 72$, so $x = 12$. **EC = 12.**

Problem 7: Side-splitter: find AD

$$\frac{x}{6} = \frac{10}{15}. \text{ Cross-multiply: } 15x = 60, \text{ so } x = 4. \text{ AD} = 4.$$

Problem 8: Converse: parallel

$$\frac{AD}{DB} = \frac{3}{5} = 0.6 \text{ and } \frac{AE}{EC} = \frac{4.5}{7.5} = 0.6. \text{ The sides are divided proportionally.}$$

Yes, DE is parallel to BC by the converse of the side-splitter theorem.

Problem 9: Converse: not parallel

$$\frac{AD}{DB} = \frac{4}{6} = \frac{2}{3} \approx 0.667 \text{ and } \frac{AE}{EC} = \frac{5}{8} = 0.625. \text{ The ratios are different.}$$

No, DE is not parallel to BC.

Problem 10: Using the whole side

$$\text{Triangle ADE is similar to triangle ABC, and } AB = 3 + 5 = 8. \text{ So } \frac{AD}{AB} = \frac{DE}{BC}: \frac{3}{8} = \frac{4.5}{x}.$$

$$3x = 36, \text{ so } x = 12. \text{ BC} = 12.$$

Problem 11: Three parallel lines

$$\text{Parallel lines divide transversals proportionally: } \frac{4}{6} = \frac{x}{9}.$$

$$6x = 36, \text{ so } x = 6. \mathbf{x = 6.}$$

Problem 12: Geometric means

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

- a. $\sqrt{36} = 6$
- b. $\sqrt{100} = 10$
- c. $\sqrt{60} = \sqrt{4 \cdot 15} = 2\sqrt{15}$
- d. $\sqrt{36} = 6$

(a) 6, (b) 10, (c) $2\sqrt{15}$, (d) 6.

Problem 13: Altitude to the hypotenuse

The altitude is the geometric mean of the two segments: $\frac{4}{x} = \frac{x}{9}$, so $x^2 = 36$.

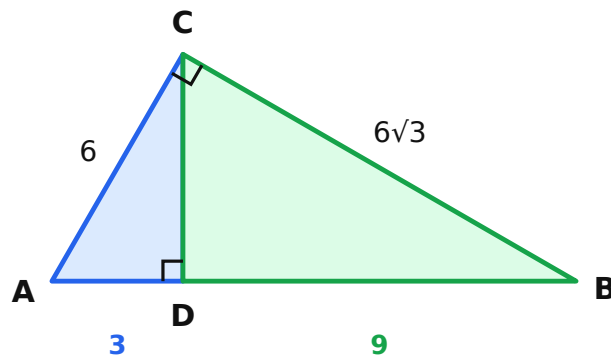
CD = 6.

Problem 14: Leg lengths

$AB = 3 + 9 = 12$. Each leg is the geometric mean of the hypotenuse and the segment next to it.

$$AC^2 = AD \cdot AB = 3 \cdot 12 = 36, \text{ so } AC = 6. \quad BC^2 = DB \cdot AB = 9 \cdot 12 = 108, \text{ so } BC = \sqrt{108} = 6\sqrt{3}.$$

Check: $6^2 + 108 = 144 = 12^2$. **AC = 6 and BC = $6\sqrt{3}$.**



AC = 6 and BC = $6\sqrt{3}$ (about 10.39).

Problem 15: Altitude, hypotenuse and legs

$$CD^2 = AD \cdot DB: 144 = 9 \cdot DB, \text{ so } DB = 16. \text{ Then } AB = 9 + 16 = 25.$$

$$AC^2 = 9 \cdot 25 = 225, \text{ so } AC = 15. \quad BC^2 = 16 \cdot 25 = 400, \text{ so } BC = 20.$$

Check: $15^2 + 20^2 = 625 = 25^2$. **DB = 16, AB = 25, AC = 15, BC = 20.**

Problem 16: Pythagorean theorem proof

The reasons are listed below.

Statements	Reasons
Right triangle ABC with right angle at C; CD is the altitude to AB	Given
Triangle ACD is similar to triangle ABC, and triangle CBD is similar to triangle ABC	AA similarity: each small triangle shares an acute angle with ABC and has a right angle
$\frac{AB}{AC} = \frac{AC}{AD}$ and $\frac{AB}{BC} = \frac{BC}{DB}$	Corresponding sides of similar triangles are proportional
$AC^2 = AB \cdot AD$ and $BC^2 = AB \cdot DB$	Cross products are equal (multiply both sides of each proportion)
$AC^2 + BC^2 = AB \cdot AD + AB \cdot DB = AB(AD + DB)$	Addition property of equality, then the distributive property
$AC^2 + BC^2 = AB^2$	Segment addition ($AD + DB = AB$) and substitution

The proof shows $AC^2 + BC^2 = AB^2$.

Problem 17: Check the leg formula

$$AC^2 = AD \cdot AB: 25 = 13 \cdot AD, \text{ so } AD = \frac{25}{13}.$$

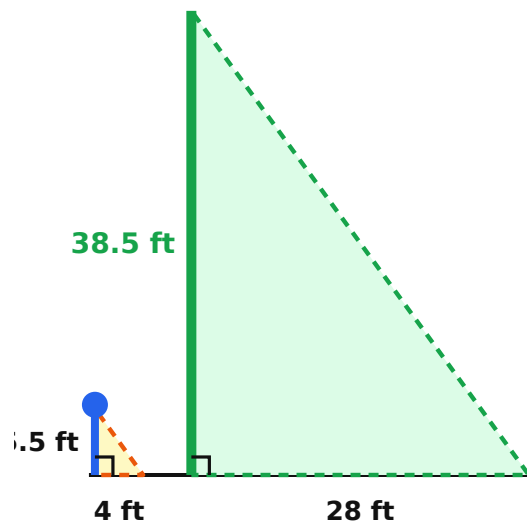
$$BC^2 = DB \cdot AB: 144 = 13 \cdot DB, \text{ so } DB = \frac{144}{13}.$$

$$\text{Sum: } \frac{25}{13} + \frac{144}{13} = \frac{169}{13} = 13. \text{ AD} = 25/13, \text{ DB} = 144/13, \text{ and they add to } 13 = \text{AB}.$$

Problem 18: Shadow of a tree

The sun's rays make the same angle with the ground, and both objects are vertical, so the right triangles are similar by AA.

$$\frac{h}{28} = \frac{5.5}{4}, \text{ so } 4h = 154 \text{ and } h = 38.5. \text{ The tree is 38.5 feet tall.}$$



The tree is 38.5 feet tall.

Problem 19: Mirror method

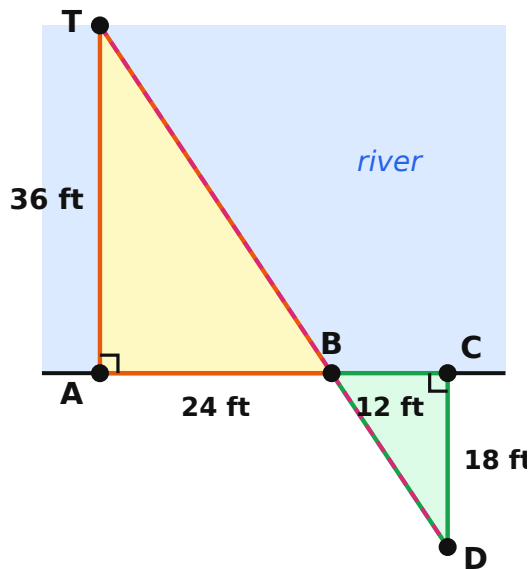
The angle of reflection equals the angle of incidence, and both triangles have a right angle, so they are similar by AA.

$\frac{h}{30} = \frac{5}{6}$, so $6h = 150$ and $h = 25$. **The flagpole is 25 feet tall.**

Problem 20: Width of a river

Angles A and C are right angles, and $\angle TBA \cong \angle DBC$ are vertical angles. So triangle TAB is similar to triangle DCB by AA.

$\frac{TA}{CD} = \frac{AB}{CB} : \frac{TA}{18} = \frac{24}{12} = 2$, so $TA = 36$. **The river is 36 feet wide.**



TA = 36 feet.

Problem 21: Solve with algebra

$\frac{x}{x+3} = \frac{6}{9}$. Cross-multiply: $9x = 6(x+3) = 6x+18$, so $3x = 18$ and $x = 6$.

$DB = 6+3 = 9$ and $AB = 6+9 = 15$. Check: $\frac{6}{9} = \frac{6}{9}$. **$x = 6$ and $AB = 15$.**

Problem 22: Flower beds

All lengths scale by $\frac{5}{3}$, including perimeter.

Perimeter: $21 \cdot \frac{5}{3} = 35$. Shortest side: $6 \cdot \frac{5}{3} = 10$. **Perimeter 35 feet; shortest side 10 feet.**

Problem 23: Sails

Scale factor: $\frac{25}{10} = 2.5$. Other sides: $6 \cdot 2.5 = 15$ and $8 \cdot 2.5 = 20$.

Perimeter: $15+20+25 = 60$, which equals $2.5 \cdot 24$. **Sides 15 ft and 20 ft; perimeter 60 ft.**

Problem 24: Lamppost shadow

The lamp, Noah and the ground form two similar right triangles. The big triangle has base $18+9 = 27$ feet, and the small one has base 9 feet.

$\frac{h}{6} = \frac{27}{9} = 3$, so $h = 18$. **The lamppost is 18 feet tall.**