

Congruent Triangles: math practice, Grade 10 – download the PDF

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Third angle



Two angles of a triangle measure 52° and 71° . Find the third angle.

2 An exterior angle



The two remote interior angles of a triangle measure 38° and 64° . Find the exterior angle, then check with the adjacent interior angle.

3 True or false?



Decide whether each statement is true or false and justify.

- Two sides and a non-included angle (SSA) prove two triangles congruent.
- Two angles and a non-included side (AAS) prove two triangles congruent.
- If three angles match, the triangles are congruent.
- Congruent triangles have equal areas.

4 Corresponding parts



$\triangle PQR \cong \triangle XYZ$. Given $PQ = 9$ cm, $QR = 12$ cm and $m\angle R = 41^\circ$, find XY , YZ and $m\angle Z$.

5 Name the criterion



Name the criterion (SSS, SAS, ASA, AAS, HL, or none) that proves the triangles congruent.

- a. Two sides and the angle between them.
- b. Two angles and the side between them.
- c. Two angles and a side not between them.
- d. Three pairs of equal sides.
- e. Two sides and an angle not between them.
- f. Two right triangles with equal hypotenuses and one pair of equal legs.

6 Isosceles and equilateral



- a. An isosceles triangle has an apex angle of 38° . Find each base angle.
- b. An equilateral triangular banner has a perimeter of 45 in. Find the side length (in inches and centimeters) and each angle.

7 Angles with algebra



The angles of a triangle measure $(x + 10)^\circ$, $(2x - 20)^\circ$ and $(3x + 10)^\circ$. Find x and the three angles. What kind of triangle is it?

8

Solve for x 

$$\triangle ABC \cong \triangle DEF.$$

- a. $AB = (3x + 2)$ cm and $DE = (5x - 10)$ cm. Find x and AB .
- b. $m\angle B = (2y + 9)^\circ$ and $m\angle E = (3y - 11)^\circ$. Find y and $m\angle B$.

9

Exterior angle equation

An exterior angle of a triangle measures $(7x - 5)^\circ$. The remote interior angles measure $(2x + 20)^\circ$ and $(3x + 15)^\circ$. Find x , the three angles involved, and the adjacent interior angle.

10

Ladders and HL

Two ladders lean against vertical walls on level ground. $\triangle ABC$ is right at B and $\triangle DEF$ is right at E . Both ladders (the hypotenuses AC and DF) are 17 ft long, and both reach a point 8 ft up the wall ($AB = DE = 8$ ft). Show that the triangles are congruent and find how far each foot is from its wall.

11

Base angles with algebra

In isosceles $\triangle ABC$ with $AB = AC$, the base angles are $\angle B = (4x - 6)^\circ$ and $\angle C = (2x + 30)^\circ$. Find x , then all three angles.

12

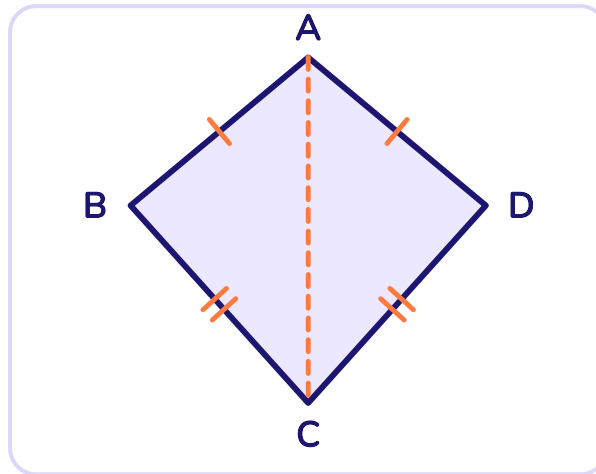
Why SSA fails

In $\triangle ABC$, $m\angle A = 30^\circ$, $AB = 8$ and $BC = 5$. Show that two different triangles fit this data by finding the two possible lengths of AC to the nearest hundredth. *Hint: the height from B to line AC is $8 \sin 30^\circ$.*

13 The kite



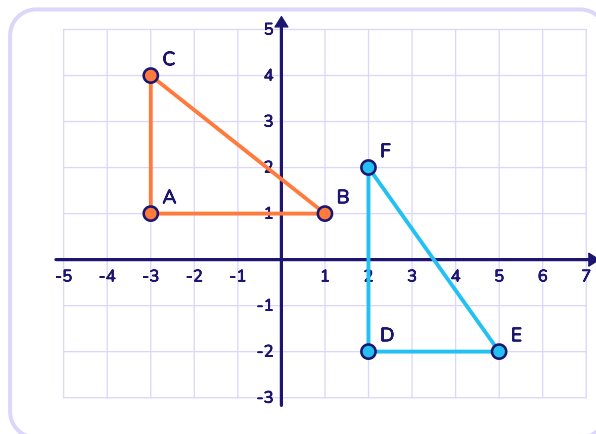
In quadrilateral $ABCD$, $AB = AD$ and $CB = CD$. Prove that $\angle B = \angle D$.



14 Congruent on a grid



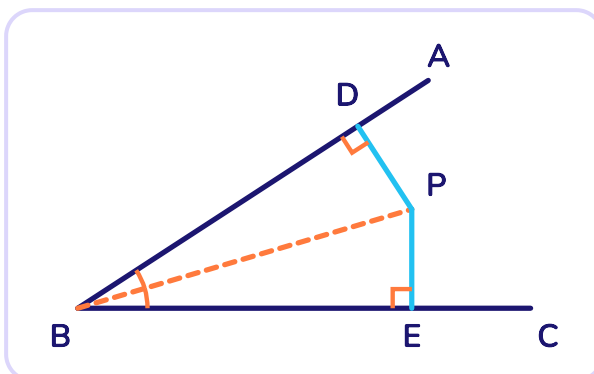
The vertices are $A(-3, 1)$, $B(1, 1)$, $C(-3, 4)$ and $D(2, -2)$, $E(5, -2)$, $F(2, 2)$. Are $\triangle ABC$ and $\triangle DEF$ congruent? If so, write the congruence with vertices in matching order.



15 Points on an angle bisector

★★★

Ray BP bisects $\angle ABC$. Point P lies on the bisector, $\overline{PD} \perp \overline{BA}$ at D and $\overline{PE} \perp \overline{BC}$ at E . Prove that $PD = PE$.

**16 The median of an isosceles triangle**

★★★

In $\triangle ABC$, $AB = AC$ and M is the midpoint of $\overline{BC}$. Prove that $\angle B = \angle C$ and that $\overline{AM} \perp \overline{BC}$.

17 The converse

★★★

In $\triangle ABC$, $\angle B = \angle C$. Let $\overline{AD}$ bisect $\angle BAC$ with D on $\overline{BC}$. Prove that $AB = AC$.

18 Equal distances in an equilateral triangle

★★★

$\triangle ABC$ is equilateral. Point D is on $\overline{AB}$ and point E is on $\overline{BC}$ with $AD = BE$. Prove that $CD = AE$.

19 A rotation on the grid

★★★

Let $A(1, 1)$, $B(7, 3)$, $C(3, 6)$ and $A'(-1, 1)$, $B'(-3, 7)$, $C'(-6, 3)$.

- Show that $\triangle ABC \cong \triangle A'B'C'$ using squared distances.
- Describe the rigid motion that maps one onto the other.

20 Across the pond

★★★

Points A and B are on opposite shores of a pond. A surveyor stands at a point C from which both are visible. She extends $\overline{AC}$ past C to a point D with $CD = CA$, and extends $\overline{BC}$ past C to a point E with $CE = CB$. She measures $DE = 46$ m. Explain why the pond measures $AB = 46$ m and convert to feet.

21 Exterior angle and a ratio

★★★

An exterior angle at vertex C of $\triangle ABC$ measures 130° . The remote interior angles satisfy $m\angle A : m\angle B = 3 : 2$. Find all three interior angles of the triangle.

22 Equal altitudes

★★★

In $\triangle ABC$, $AB = AC$. The altitude from B meets $\overline{AC}$ at E and the altitude from C meets $\overline{AB}$ at F . Prove that $BE = CF$.

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