

CUT & GLUE SORT

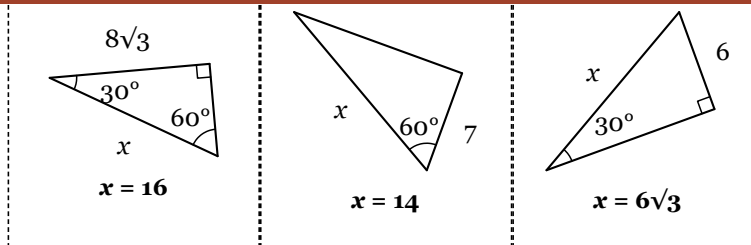


30-60-90 SPECIAL RIGHT TRIANGLES

30-60-90 Triangles: Is x Right?

Twelve triangles · right, wrong, or the marks do not say · three rows

FREE



Row 1. Correct: x is right.

Row 2. Wrong: x is not right.

Row 3. Cannot tell: the marks do not show that this is a 30-60-90 triangle.

Cut & Glue Sort — how to run it

25 minutes, including the cutting

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“Read the marks first. Is it a 30-60-90 triangle? If yes, find the shorter leg first, then check x.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheets	pages 3 and 4, one of each per student. Page 3 has the three rows. Page 4 has the pieces and the rule as a labeled triangle.
Answers	page 5.

Each piece is a triangle drawn to scale, with one length and a value for x . When the marks show a 30-60-90 triangle, the student finds the shorter leg (across from the 30° angle), then x . The longer leg is the shorter leg times $\sqrt{3}$, and the hypotenuse is the shorter leg times 2. Row 1 holds the right values. Row 2 holds the two common mistakes. In the first, the $\sqrt{3}$ and the 2 trade places: the hypotenuse is taken as the shorter leg times $\sqrt{3}$, or the longer leg as the shorter leg times 2. In the second, a side is doubled that is not the shorter leg, such as the longer leg or the altitude.

The last row is the most important. Its four triangles look exactly like 30-60-90 triangles, and the value of x is the one a 30-60-90 triangle would give. But the marks do not prove the angles. A 60° angle or a 30° angle alone does not fix the other angles. Two sides marked equal do not make a triangle equilateral. The rules for 30-60-90 triangles work only when the angles are known, so the honest answer is “cannot tell.”

A student who trusts the drawing and never reads the marks places only eight pieces correctly. Ask that student: *“Which marks tell you the angles?”* Guessing rules place at most six pieces correctly.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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Cut & Glue Sort — is x right?

30-60-90 triangles

Name _____

Period _____

Date _____

Each piece on the next page is a triangle with some marks, one length, and a value for x . **First read the marks. Do they show a 30-60-90 triangle? If yes, find x and check the value. Glue the piece in its row.**

Row 1. Correct: x is right.

Row 2. Wrong: x is not right.

Row 3. Cannot tell: the marks do not show that this is a 30-60-90 triangle.

Cut & Glue Sort — the pieces

Cut along the dashed lines

Cut out the twelve pieces. Glue each one in its row on the other sheet. A square in a corner means a right angle. Ticks on two sides mean those sides are equal.

shorter leg 60° hypotenuse
30°
longer leg

Find the shorter leg first. It is across from the 30° angle.
 longer leg = shorter leg $\times \sqrt{3}$ hypotenuse = shorter leg $\times 2$
 $\sqrt{3} \approx 1.73$, so the longer leg is shorter than the hypotenuse.

1 $x = 16$	2 $x = 14$	3 $x = 6\sqrt{3}$	4 The altitude is $4\sqrt{3}$. $x = 8\sqrt{3}$
5 $x = 7\sqrt{3}$	6 The altitude is $5\sqrt{3}$. $x = 5$	7 $x = 10$	8 $x = 18$
9 $x = 20\sqrt{3}$	10 The altitude is $6\sqrt{3}$. $x = 12$	11 $x = 16$	12 The altitude is $3\sqrt{3}$. $x = 6$



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Each row holds four pieces. Every piece is described again here, with the reason.

1 Correct: x is right.

1. Marks: a right angle, 30° , 60° . The longer leg is $8\sqrt{3}$; x is the hypotenuse. The piece says $x = 16$. *Why:* The $8\sqrt{3}$ is the longer leg, so the shorter leg is 8. x is the hypotenuse: $2 \times 8 = 16$.

5. Marks: 30° , 60° . The hypotenuse is 14; x is the longer leg. The piece says $x = 7\sqrt{3}$. *Why:* The angles 30° and 60° make the third angle 90° . The 14 is the hypotenuse, so the shorter leg is 7. x is the longer leg: $7 \times \sqrt{3} = 7\sqrt{3}$.

8. Marks: a right angle, 30° . The shorter leg is 9; x is the hypotenuse. The piece says $x = 18$. *Why:* The 9 is the shorter leg. x is the hypotenuse: $2 \times 9 = 18$.

10. Marks: 60° at both base corners, a right angle where the altitude meets the base. The altitude is $6\sqrt{3}$; x is the side. The piece says $x = 12$. *Why:* Both base angles are 60° , so the triangle is equilateral and the altitude cuts it into two 30-60-90 triangles. The altitude $6\sqrt{3}$ is a longer leg, so the shorter leg is $6\sqrt{3} \div \sqrt{3} = 6$. x is the side: $2 \times 6 = 12$.

2 Wrong: x is not right.

3. Marks: a right angle, 30° . The shorter leg is 6; x is the hypotenuse. The piece says $x = 6\sqrt{3}$. *Why:* The 6 is the shorter leg. x is the hypotenuse: $2 \times 6 = 12$. The piece says $6\sqrt{3}$.

4. Marks: 60° at both base corners, a right angle where the altitude meets the base. The altitude is $4\sqrt{3}$; x is the side. The piece says $x = 8\sqrt{3}$. *Why:* Both base angles are 60° , so the triangle is equilateral and the altitude cuts it into two 30-60-90 triangles. The altitude $4\sqrt{3}$ is a longer leg, so the shorter leg is $4\sqrt{3} \div \sqrt{3} = 4$. x is the side: $2 \times 4 = 8$. The piece says $8\sqrt{3}$.

9. Marks: a right angle, 30° , 60° . The longer leg is $10\sqrt{3}$; x is the hypotenuse. The piece says $x = 20\sqrt{3}$. *Why:* The $10\sqrt{3}$ is the longer leg, so the shorter leg is 10. x is the hypotenuse: $2 \times 10 = 20$. The piece says $20\sqrt{3}$.

11. Marks: a right angle, 30° . The shorter leg is 8; x is the longer leg. The piece says $x = 16$. *Why:* The 8 is the shorter leg. x is the longer leg: $8 \times \sqrt{3} = 8\sqrt{3}$. The piece says 16.

3 Cannot tell: the marks do not show that this is a 30-60-90 triangle.

2. Marks: 60° . The side that looks like the shorter leg is 7; x is on the side that looks like the hypotenuse. The piece says $x = 14$. *Why:* Only the 60° angle is marked. Nothing says the corner that looks square is 90° , so the other two angles are not known.

6. Marks: two sides marked equal, a right angle where the altitude meets the base. The altitude is $5\sqrt{3}$; x is half of the base. The piece says $x = 5$. *Why:* Only two sides are marked equal, so the angles are not known. It looks equilateral, but it is not known to be. So x could be any length.

7. Marks: 30° . The side that looks like the shorter leg is 5; x is on the side that looks like the hypotenuse. The piece says $x = 10$. *Why:* Only the 30° angle is marked. Nothing says the corner that looks square is 90° , so the other two angles are not known.

12. Marks: two sides marked equal, a right angle where the altitude meets the base. The altitude is $3\sqrt{3}$; x is the side. The piece says $x = 6$. *Why:* Only two sides are marked equal, so the angles are not known. It looks equilateral, but it is not known to be. So x could be any length.

To check a piece with a student, ask two questions. First: do the marks show a 30-60-90 triangle? You need two of its angles, or 60° at both base corners of a triangle cut by its altitude. If no, the piece goes in row 3. If yes, find the shorter leg first, then x. If the value on the piece matches, it goes in row 1. If not, row 2.