

ANSWER MAZE



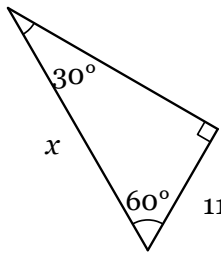
30-60-90 SPECIAL RIGHT TRIANGLES

Where Does the $\sqrt{3}$ Go?

30-60-90 triangles · one page · 10–15 minutes · nothing to prepare

FREE

5 Find x .

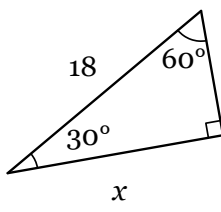


$x = 11\sqrt{3}$
→ go to box 7

$x = 22$
→ go to box 2

Hint: Look at the side across from the right angle. Which factor belongs to it?

2 Find x .



$x = 9\sqrt{3}$
→ go to box 8

$x = 18\sqrt{3}$
→ go to box 4

Hint: Find the shorter leg first. Where is it in this triangle?

1. **Hand out page 3**, one per student. Nothing else is needed.
2. **Say this once:** *“Start at box 5. Find the shorter leg first. It is across from the 30° angle. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet quickly.** A student with no mistakes writes **5 2 8 3 6 1**: six boxes, then out.

Student sheet	page 3, one per student, and scrap paper for working.
Answers	page 4.

Every box shows a 30-60-90 triangle drawn to scale, turned a different way, with its angles marked. In box 3 it is half of an equilateral triangle, cut by the altitude. The longer leg is the shorter leg times $\sqrt{3}$, and the hypotenuse is the shorter leg times 2.

Every wrong answer comes from one of two 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. These wrong answers send the student to box 7.

In the second, the student starts from the given side as if it were the shorter leg. The longer leg is doubled (the altitude of an equilateral triangle is a longer leg too), or the hypotenuse is multiplied by $\sqrt{3}$ without halving it first. These wrong answers send the student to box 4. Boxes 7 and 4 ask the same kind of question again, and both of their answers lead back to the route.

The row at the bottom is the check. A clean run is six numbers. Each wrong answer adds at least one more. Guessing does not get a student out: every simple guessing rule, such as always taking the larger number, goes wrong within the first three boxes.



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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Answer Maze — where does the $\sqrt{3}$ go?

Start at box 5

Name _____

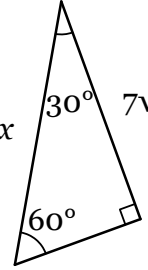
Period _____

Date _____

Start at box 5. Find x . Pick one answer and go to the box it names. Write each box number in the row at the bottom as you go.

Find the shorter leg first. It is across from the 30° angle. Longer leg = shorter leg $\times \sqrt{3}$. Hypotenuse = shorter leg $\times 2$.

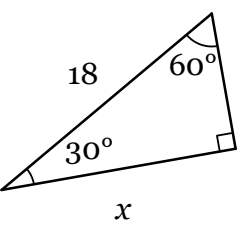
1 Find x .



$x = 14$
→ you are out
 $x = 14\sqrt{3}$
→ go to box 4

Hint: Which leg doubles to make the hypotenuse? Find that leg first.

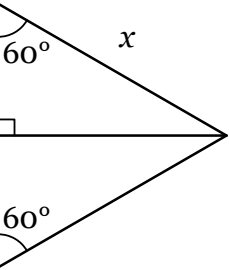
2 Find x .



$x = 9\sqrt{3}$
→ go to box 8
 $x = 18\sqrt{3}$
→ go to box 4

Hint: Find the shorter leg first. Where is it in this triangle?

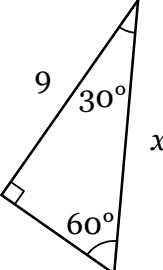
3 Equilateral triangle. The altitude is $5\sqrt{3}$. Find x .



$x = 10\sqrt{3}$
→ go to box 4
 $x = 10$
→ go to box 6

Hint: The altitude is a leg of each half. Find the shorter leg of that half first.

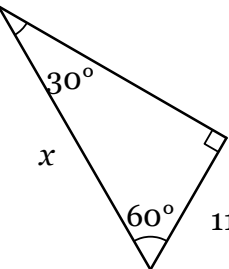
4 Find x .



$x = 6\sqrt{3}$
→ go to box 8
 $x = 18$
→ go to box 2

Hint: Which leg doubles to make the hypotenuse? Look for that leg first.

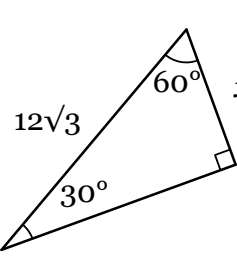
5 Find x .



$x = 11\sqrt{3}$
→ go to box 7
 $x = 22$
→ go to box 2

Hint: Look at the side across from the right angle. Which factor belongs to it?

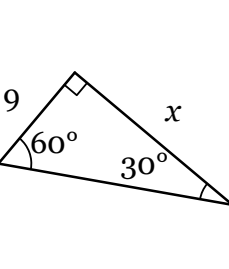
6 Find x .



$x = 6\sqrt{3}$
→ go to box 1
 $x = 12$
→ go to box 7

Hint: Look at the hypotenuse. How is it made from the shorter leg?

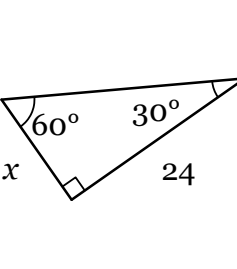
7 Find x .



$x = 18$
→ go to box 5
 $x = 9\sqrt{3}$
→ go to box 2

Hint: Point to the side across from the larger acute angle. Which factor belongs on it?

8 Find x .



$x = 12$
→ go to box 7
 $x = 8\sqrt{3}$
→ go to box 3

Hint: Which angle is across from the given side? Which factor belongs to that side?

Write every box number here, in order.

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The route, in order. Boxes 7 and 4 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table.

5 → 2 → 8 → 3 → 6 → 1 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 5 A 30-60-90 triangle. The shorter leg is 11. Find x, the hypotenuse.	22. The 11 is across from the 30° angle, so it is the shorter leg. x is the hypotenuse: $2 \times 11 = 22$.	" $11\sqrt{3}$ " goes to box 7. A student who puts the $\sqrt{3}$ on the hypotenuse gets $11 \times \sqrt{3} = 11\sqrt{3}$.
2	Box 2 A 30-60-90 triangle. The hypotenuse is 18. Find x, the longer leg.	$9\sqrt{3}$. The 18 is across from the right angle, so it is the hypotenuse. The shorter leg is half of it, 9. x is the longer leg: $9 \times \sqrt{3} = 9\sqrt{3}$.	" $18\sqrt{3}$ " goes to box 4. A student who multiplies the hypotenuse by $\sqrt{3}$ with no halving first gets $18 \times \sqrt{3} = 18\sqrt{3}$.
3	Box 8 A 30-60-90 triangle. The longer leg is 24. Find x, the shorter leg.	$8\sqrt{3}$. The 24 is across from the 60° angle, so it is the longer leg. The shorter leg is $24 \div \sqrt{3} = 24\sqrt{3} \div 3 = 8\sqrt{3}$. So $x = 8\sqrt{3}$.	"12" goes to box 7. A student who takes the longer leg as twice the shorter leg gets $24 \div 2 = 12$.
4	Box 3 An equilateral triangle with its altitude. The altitude is $5\sqrt{3}$. Find x, the side.	10. The altitude cuts the equilateral triangle into two 30-60-90 triangles. The altitude $5\sqrt{3}$ is the longer leg, so the shorter leg is $5\sqrt{3} \div \sqrt{3} = 5$. The side is the hypotenuse: $2 \times 5 = 10$.	" $10\sqrt{3}$ " goes to box 4. A student who doubles the altitude as if it were the shorter leg gets $2 \times 5\sqrt{3} = 10\sqrt{3}$.
5	Box 6 A 30-60-90 triangle. The hypotenuse is $12\sqrt{3}$. Find x, the shorter leg.	$6\sqrt{3}$. The $12\sqrt{3}$ is across from the right angle, so it is the hypotenuse. The shorter leg is half of it, $6\sqrt{3}$. So $x = 6\sqrt{3}$.	"12" goes to box 7. A student who takes the hypotenuse as the shorter leg times $\sqrt{3}$ gets $12\sqrt{3} \div \sqrt{3} = 12$.
6	Box 1 A 30-60-90 triangle. The longer leg is $7\sqrt{3}$. Find x, the hypotenuse.	14. The $7\sqrt{3}$ is across from the 60° angle, so it is the longer leg. The shorter leg is $7\sqrt{3} \div \sqrt{3} = 7$. x is the hypotenuse: $2 \times 7 = 14$.	" $14\sqrt{3}$ " goes to box 4. A student who doubles the longer leg gets $2 \times 7\sqrt{3} = 14\sqrt{3}$. Only the shorter leg doubles.
	Box 7 A 30-60-90 triangle. The shorter leg is 9. Find x, the longer leg.	$9\sqrt{3}$. The 9 is across from the 30° angle, so it is the shorter leg. x is the longer leg: $9 \times \sqrt{3} = 9\sqrt{3}$.	"18" goes to box 5. A student who puts the 2 on the longer leg gets $2 \times 9 = 18$.
	Box 4 A 30-60-90 triangle. The longer leg is 9. Find x, the hypotenuse.	$6\sqrt{3}$. The 9 is across from the 60° angle, so it is the longer leg. The shorter leg is $9 \div \sqrt{3} = 9\sqrt{3} \div 3 = 3\sqrt{3}$. x is the hypotenuse: $2 \times 3\sqrt{3} = 6\sqrt{3}$.	"18" goes to box 2. A student who doubles the longer leg gets $2 \times 9 = 18$. Only the shorter leg doubles.

How to check any box. Find the 30° angle. The side across from it is the shorter leg. Find the shorter leg first, from whatever side is given. Then the longer leg is the shorter leg times $\sqrt{3}$, and the hypotenuse is the shorter leg times 2. In a correct answer the hypotenuse is exactly twice the shorter leg.

A student can find the last four boxes of the route by following the arrows backward from "you are out." So ask a student with a clean row to explain one box.