

ANSWER MAZE

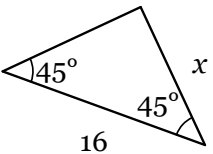


45-45-90 SPECIAL RIGHT TRIANGLES

Which Way: Times $\sqrt{2}$ or Divide by $\sqrt{2}$?

One page · 10–15 minutes · nothing to prepare

FREE

3  Find x. $16\sqrt{2} \rightarrow$ go to box 7 $8\sqrt{2} \rightarrow$ go to box 6 <i>Hint: The two marked angles leave a third corner. Which side is across from it?</i>	6 A square has sides of 6. How long is its diagonal? $3\sqrt{2} \rightarrow$ go to box 5 $6\sqrt{2} \rightarrow$ go to box 1 <i>Hint: The diagonal cuts the square into two triangles. Is the diagonal a leg or the hypotenuse?</i>
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1. **Hand out page 3**, one per student. Nothing else is needed.
2. **Say this once:** *“Start at box 3. In every box, find the hypotenuse first. From a leg to the hypotenuse, multiply by $\sqrt{2}$. From the hypotenuse to a leg, divide by $\sqrt{2}$. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet quickly.** A student with no mistakes writes **3 6 1 8 4 2**: six boxes, then out.

Student sheet page 3, one per student. A strip at the top shows the rule as a small drawing.
Answers page 4.

Every wrong answer comes from going the wrong way. Four of the six boxes on the route give the hypotenuse and ask for a leg. The common mistake there is to multiply by $\sqrt{2}$ instead of dividing. That answer is longer than the hypotenuse, and it sends the student to box 7. The other boxes give a leg and ask for the hypotenuse. A student who divides there gets an answer shorter than the leg, and goes to box 5. Boxes 7 and 5 ask the same kind of question again, and both of their answers lead back to the route.

Exact answers. Dividing by $\sqrt{2}$ gives a fraction with $\sqrt{2}$ on the bottom. For example, $16 \div \sqrt{2}$ is the same number as $16\sqrt{2} \div 2$, which is $8\sqrt{2}$: multiply the top and the bottom by $\sqrt{2}$, because $\sqrt{2} \times \sqrt{2} = 2$. The answers on the sheet use that second form.

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 smaller number, goes wrong within the first four 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 — times $\sqrt{2}$ or divide by $\sqrt{2}$?

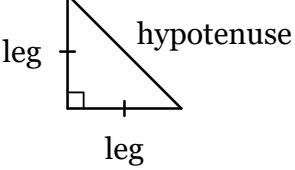
Start at box 3

Name _____

Period _____

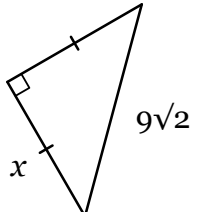
Date _____

Start at box 3. Find the length the box asks for. Pick the answer you got and go to the box it names. Write each box number in the row at the bottom as you go.



45-45-90 triangle: a right angle and two equal legs. Its acute angles are 45° and 45° .
 $\text{leg} \times \sqrt{2} = \text{hypotenuse}$ $\text{hypotenuse} \div \sqrt{2} = \text{leg}$
 Check: the hypotenuse is longer than a leg, and shorter than two legs put together.

1

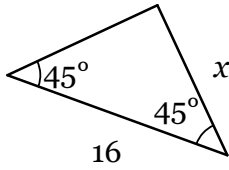


Find x.
 $18 \rightarrow$ go to box 7
 $9 \rightarrow$ go to box 8
Hint: Which side is across from the right angle? Is that side given, or asked for?

2

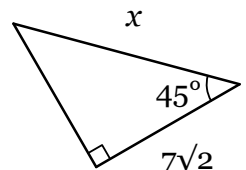
An isosceles right triangle has a hypotenuse of 26.
How long is each leg?
 $13\sqrt{2} \rightarrow$ you are out
 $26\sqrt{2} \rightarrow$ go to box 7
Hint: Which side of this triangle is the hypotenuse? Is that side given here?

3



Find x.
 $16\sqrt{2} \rightarrow$ go to box 7
 $8\sqrt{2} \rightarrow$ go to box 6
Hint: The two marked angles leave a third corner. Which side is across from it?

4



Find x.
 $14 \rightarrow$ go to box 2
 $7 \rightarrow$ go to box 5
Hint: Look at the right-angle mark. Is the given length on a leg or on the hypotenuse?

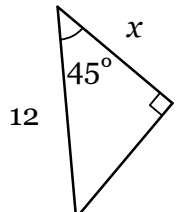
5

A 45-45-90 triangle has two legs of 10.
How long is its hypotenuse?
 $5\sqrt{2} \rightarrow$ go to box 6
 $10\sqrt{2} \rightarrow$ go to box 1
Hint: Which side is the hypotenuse? Is the given length on a leg?

6

A square has sides of 6.
How long is its diagonal?
 $3\sqrt{2} \rightarrow$ go to box 5
 $6\sqrt{2} \rightarrow$ go to box 1
Hint: The diagonal cuts the square into two triangles. Is the diagonal a leg or the hypotenuse?

7



Find x.
 $6\sqrt{2} \rightarrow$ go to box 6
 $12\sqrt{2} \rightarrow$ go to box 3
Hint: Look at the right-angle mark. Which side is across from it, and which side is asked for?

8

A square has a diagonal of 20.
How long is each side?
 $10\sqrt{2} \rightarrow$ go to box 4
 $20\sqrt{2} \rightarrow$ go to box 7
Hint: Draw the square and its diagonal. In each triangle, which side is the diagonal?

Write every box number here, in order.

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Answer Maze — answers

For the teacher

The route, in order. Boxes 7 and 5 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table.

3 → 6 → 1 → 8 → 4 → 2 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 3 A triangle with two angles marked 45° and no right-angle mark. The hypotenuse is 16. Find a leg, x .	$8\sqrt{2}$. Two 45° angles leave 90° for the third corner. The side across from that corner is the hypotenuse. A leg is the hypotenuse $\div \sqrt{2}$: $16 \div \sqrt{2} = 16\sqrt{2} \div 2 = 8\sqrt{2}$.	" $16\sqrt{2}$ " goes to box 7. A student who multiplies by $\sqrt{2}$ instead of dividing gets $16\sqrt{2}$. That is longer than the hypotenuse, so it cannot be a leg.
2	Box 6 A square has sides of 6. How long is its diagonal?	$6\sqrt{2}$. The hypotenuse is a leg $\times \sqrt{2}$: $6 \times \sqrt{2} = 6\sqrt{2}$.	" $3\sqrt{2}$ " goes to box 5. A student who divides by $\sqrt{2}$ instead of multiplying gets $3\sqrt{2}$. That is shorter than the leg, so it cannot be the hypotenuse.
3	Box 1 A triangle with a right-angle mark and one tick on each short side. The hypotenuse is $9\sqrt{2}$. Find a leg, x .	9. The right angle and the two equal legs make it a 45-45-90 triangle. A leg is the hypotenuse $\div \sqrt{2}$: $9\sqrt{2} \div \sqrt{2} = 9$.	"18" goes to box 7. A student who multiplies by $\sqrt{2}$ instead of dividing gets 18. That is longer than the hypotenuse, so it cannot be a leg.
4	Box 8 A square has a diagonal of 20. How long is each side?	$10\sqrt{2}$. A leg is the hypotenuse $\div \sqrt{2}$: $20 \div \sqrt{2} = 20\sqrt{2} \div 2 = 10\sqrt{2}$.	" $20\sqrt{2}$ " goes to box 7. A student who multiplies by $\sqrt{2}$ instead of dividing gets $20\sqrt{2}$. That is longer than the hypotenuse, so it cannot be a leg.
5	Box 4 A triangle with a right-angle mark and one angle marked 45° . One leg is $7\sqrt{2}$. Find the hypotenuse, x .	14. A right angle and a 45° angle leave 45° for the third corner, so the legs are equal. The hypotenuse is a leg $\times \sqrt{2}$: $7\sqrt{2} \times \sqrt{2} = 7 \times 2 = 14$.	"7" goes to box 5. A student who divides by $\sqrt{2}$ instead of multiplying gets 7. That is shorter than the leg, so it cannot be the hypotenuse.
6	Box 2 An isosceles right triangle has a hypotenuse of 26. How long is each leg?	$13\sqrt{2}$. A leg is the hypotenuse $\div \sqrt{2}$: $26 \div \sqrt{2} = 26\sqrt{2} \div 2 = 13\sqrt{2}$.	" $26\sqrt{2}$ " goes to box 7. A student who multiplies by $\sqrt{2}$ instead of dividing gets $26\sqrt{2}$. That is longer than the hypotenuse, so it cannot be a leg.
	Box 7 A triangle with a right-angle mark and one angle marked 45° . The hypotenuse is 12. Find a leg, x .	$6\sqrt{2}$. A right angle and a 45° angle leave 45° for the third corner, so the legs are equal. A leg is the hypotenuse $\div \sqrt{2}$: $12 \div \sqrt{2} = 12\sqrt{2} \div 2 = 6\sqrt{2}$.	" $12\sqrt{2}$ " goes to box 3. A student who multiplies by $\sqrt{2}$ instead of dividing gets $12\sqrt{2}$. That is longer than the hypotenuse, so it cannot be a leg.
	Box 5 A 45-45-90 triangle has two legs of 10. How long is its hypotenuse?	$10\sqrt{2}$. The hypotenuse is a leg $\times \sqrt{2}$: $10 \times \sqrt{2} = 10\sqrt{2}$.	" $5\sqrt{2}$ " goes to box 6. A student who divides by $\sqrt{2}$ instead of multiplying gets $5\sqrt{2}$. That is shorter than the leg, so it cannot be the hypotenuse.

How to check any box. Find the hypotenuse: it is across from the right angle. A square's diagonal is the hypotenuse of half the square. If the hypotenuse is asked for, multiply the leg by $\sqrt{2}$. If a leg is asked for, divide the hypotenuse by $\sqrt{2}$. The hypotenuse is always longer than a leg and shorter than two legs put together.

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.