

ANSWER MAZE

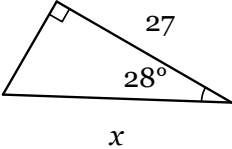
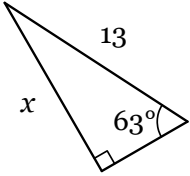


USING TRIG RATIOS TO FIND A SIDE

Trig Ratios: x on Top or Underneath?

Finding a side with sine, cosine and tangent · one page · 10–15 minutes
· nothing to prepare

FREE

 3 Find x. $x = 23.8$ → go to box 5 $x = 30.6$ → go to box 7 <i>Hint: Look at the side marked x. Is it the longest side of the triangle?</i>	 7 Find x. $x = 11.6$ → go to box 1 $x = 5.9$ → go to box 4 <i>Hint: Point to the given angle. Which leg touches it, and which leg is across from it?</i>
---	--

1. **Hand out page 3**, one per student, and a calculator. Nothing else is needed.
2. **Say this once:** *“Start at box 3. Set your calculator to degrees: $\sin 30$ must show 0.5. Name the ratio and write the equation first. 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 7 1 6 2 8**: six boxes, then out.

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

Every box shows a right triangle drawn to scale, turned a different way, with one acute angle marked. Students name each side from that angle: the opposite leg is across from it, the adjacent leg touches it, and the hypotenuse is across from the right angle. On four of the six boxes of the route, x is underneath in the fraction, so the last step is a division.

Every wrong answer comes from one of two mistakes. In the first, the student multiplies where the equation divides, or divides where it multiplies. These wrong answers send the student to box 5. In the second, the student mixes up opposite and adjacent, so cosine is used in place of sine or sine in place of cosine. These wrong answers send the student to box 4. Boxes 5 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.

chooseyourlesson.com — 135 free geometry lessons.

Answer Maze — x on top or underneath?

Start at box 3

Name _____

Period _____

Date _____

Start at box 3. Find x to the nearest tenth. Pick one answer and go to the box it names. Write each box number in the row at the bottom as you go.

Name the sides from the given angle. $\sin = \text{opposite} \div \text{hypotenuse}$ $\cdot \cos = \text{adjacent} \div \text{hypotenuse}$ $\cdot \tan = \text{opposite} \div \text{adjacent}$
 x on top of the fraction: multiply. x underneath: divide. The hypotenuse is the longest side. Check that your answer fits.
 Calculator in degree mode: $\sin 30$ must show 0.5. Keep every digit of the ratio. Round only at the end.

1 Find x .

$x = 23.1$
→ go to box 5

$x = 9.7$
→ go to box 6

Hint: Write the equation before the calculator. Where does x sit in the fraction?

2 Find x .

$x = 9.4$
→ go to box 8

$x = 56.5$
→ go to box 5

Hint: A leg and the hypotenuse: which of the two is longer?

3 Find x .

$x = 23.8$
→ go to box 5

$x = 30.6$
→ go to box 7

Hint: Look at the side marked x . Is it the longest side of the triangle?

4 Find x .

$x = 11.7$
→ go to box 7

$x = 17.4$
→ go to box 1

Hint: Which leg touches the given angle? Look for the ratio that uses that leg.

5 Find x .

$x = 6.5$
→ go to box 7

$x = 12.4$
→ go to box 3

Hint: In tan, which leg is on top? Then where does x stand in the equation?

6 Find x .

$x = 36.6$
→ go to box 2

$x = 31.8$
→ go to box 4

Hint: Find the side across from the given angle. Which ratio uses that side and the hypotenuse?

7 Find x .

$x = 11.6$
→ go to box 1

$x = 5.9$
→ go to box 4

Hint: Point to the given angle. Which leg touches it, and which leg is across from it?

8 Find x .

$x = 47.2$
→ go to box 4

$x = 29.5$
→ you are out

Hint: Name each side from the given angle. Which leg runs from that angle to the square corner?

Write every box number here, in order.

--	--	--	--	--	--	--	--	--	--



chooseyourlesson.com
135 free geometry lessons

The route, in order. Boxes 5 and 4 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table. Every ratio is the calculator's value in degree mode, to four places, and the answer is rounded only at the end.

3 → 7 → 1 → 6 → 2 → 8 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 3 A right triangle with a 28° angle. The leg that touches the 28° angle is 27. Find x , the hypotenuse.	30.6. The 27 touches the 28° angle and is not the hypotenuse, so it is the adjacent leg. x is across from the right angle, so it is the hypotenuse. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 28^\circ = 27 \div x$. x is underneath, so divide: $27 \div 0.8829 = 30.6$.	"23.8" goes to box 5. Multiplying where the equation divides: $27 \times \cos 28^\circ = 23.8$. It is shorter than the leg 27, and the hypotenuse is the longest side.
2	Box 7 A right triangle with a 63° angle. The hypotenuse is 13. Find x , the leg across from the 63° angle.	11.6. The 13 is across from the right angle, so it is the hypotenuse. x is across from the 63° angle, so it is the opposite leg. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 63^\circ = x \div 13$. x is on top, so multiply: $13 \times 0.8910 = 11.6$.	"5.9" goes to box 4. Opposite and adjacent swapped, so $\cos$ is used in place of $\sin$: $13 \times \cos 63^\circ = 5.9$. Nothing in the arithmetic shows this mistake.
3	Box 1 A right triangle with a 57° angle. The leg across from the 57° angle is 15. Find x , the leg that touches the 57° angle.	9.7. The 15 is across from the 57° angle, so it is the opposite leg. x touches the 57° angle and is not the hypotenuse, so it is the adjacent leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 57^\circ = 15 \div x$. x is underneath, so divide: $15 \div 1.5399 = 9.7$.	"23.1" goes to box 5. Multiplying where the equation divides: $15 \times \tan 57^\circ = 23.1$.
4	Box 6 A right triangle with a 41° angle. The leg across from the 41° angle is 24. Find x , the hypotenuse.	36.6. The 24 is across from the 41° angle, so it is the opposite leg. x is across from the right angle, so it is the hypotenuse. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 41^\circ = 24 \div x$. x is underneath, so divide: $24 \div 0.6561 = 36.6$.	"31.8" goes to box 4. Opposite and adjacent swapped, so $\cos$ is used in place of $\sin$: $24 \div \cos 41^\circ = 31.8$. Nothing in the arithmetic shows this mistake.
5	Box 2 A right triangle with a 66° angle. The hypotenuse is 23. Find x , the leg that touches the 66° angle.	9.4. The 23 is across from the right angle, so it is the hypotenuse. x touches the 66° angle and is not the hypotenuse, so it is the adjacent leg. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 66^\circ = x \div 23$. x is on top, so multiply: $23 \times 0.4067 = 9.4$.	"56.5" goes to box 5. Dividing where the equation multiplies: $23 \div \cos 66^\circ = 56.5$. It is longer than the hypotenuse 23, and a leg never is.
6	Box 8 A right triangle with a 32° angle. The leg that touches the 32° angle is 25. Find x , the hypotenuse.	29.5. The 25 touches the 32° angle and is not the hypotenuse, so it is the adjacent leg. x is across from the right angle, so it is the hypotenuse. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 32^\circ = 25 \div x$. x is underneath, so divide: $25 \div 0.8480 = 29.5$.	"47.2" goes to box 4. Opposite and adjacent swapped, so $\sin$ is used in place of $\cos$: $25 \div \sin 32^\circ = 47.2$. Nothing in the arithmetic shows this mistake.
	Box 5 A right triangle with a 36° angle. The leg that touches the 36° angle is 9. Find x , the leg across from the 36° angle.	6.5. The 9 touches the 36° angle and is not the hypotenuse, so it is the adjacent leg. x is across from the 36° angle, so it is the opposite leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 36^\circ = x \div 9$. x is on top, so multiply: $9 \times 0.7265 = 6.5$.	"12.4" goes to box 3. Dividing where the equation multiplies: $9 \div \tan 36^\circ = 12.4$.
	Box 4 A right triangle with a 34° angle. The hypotenuse is 21. Find x , the leg that touches the 34° angle.	17.4. The 21 is across from the right angle, so it is the hypotenuse. x touches the 34° angle and is not the hypotenuse, so it is the adjacent leg. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 34^\circ = x \div 21$. x is on top, so multiply: $21 \times 0.8290 = 17.4$.	"11.7" goes to box 7. Opposite and adjacent swapped, so $\sin$ is used in place of $\cos$: $21 \times \sin 34^\circ = 11.7$. Nothing in the arithmetic shows this mistake.

How to check any box. Find the marked angle. Name the three sides from it. Pick the ratio that uses the side with the number and the side marked x . If x is on top of the fraction, multiply. If it is underneath, divide. A leg is always shorter than the hypotenuse.

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.