

ANSWER MAZE

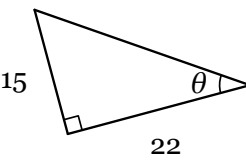
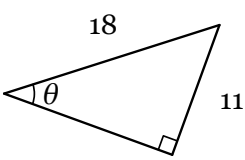


INVERSE TRIG RATIOS: FINDING AN ANGLE

Which Key Finds θ ?

Inverse trig ratios · one page · 10–15 minutes · nothing to prepare but calculators

FREE

	6 Find θ. $\theta = 43^\circ \rightarrow$ go to box 8 $\theta = 34^\circ \rightarrow$ go to box 3 <i>Hint: Look at the two sides with numbers. Does the hypotenuse have one?</i>
	3 Find θ. $\theta = 38^\circ \rightarrow$ go to box 7 $\theta = 52^\circ \rightarrow$ go to box 2 <i>Hint: Put a finger on the arc. Which side is across from it?</i>

1. **Hand out page 3**, one per student. Each student needs a calculator.
2. **Say this once:** *“Start at box 6. Put your calculator in degree mode. Find the ratio of the two sides first, then use $\sin^{-1}$, $\cos^{-1}$ or $\tan^{-1}$. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet quickly.** A student with no mistakes writes **6 3 7 1 5 4**: 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. The angle to find is marked with an arc and θ , and two sides have their lengths. Every answer is rounded to the nearest degree. To check the mode, press $\sin 30$. A calculator in degree mode shows 0.5.

This sheet writes the calculator keys $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$. Read $\sin^{-1}(0.6)$ as “the angle whose sine is 0.6.” Some textbooks write $\arcsin$, $\arccos$ and $\arctan$ instead. Some textbooks use other definitions, so tell the class which ones this sheet uses.

Every wrong answer comes from one of two mistakes. In the first, the student finds the other acute angle, 90° minus θ . This comes from the wrong corner, from $\sin^{-1}$ where $\cos^{-1}$ belongs (or the reverse), or from a tangent turned upside down. These wrong answers send the student to box 2. In the second, the student presses the wrong key: $\sin^{-1}$ on two legs, or $\tan^{-1}$ on a leg and the hypotenuse. These send the student to box 8. Boxes 2 and 8 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 angle, goes wrong within the first four boxes. The triangles are drawn to scale, so keep protractors away.



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 — which key finds θ ?

Start at box 6

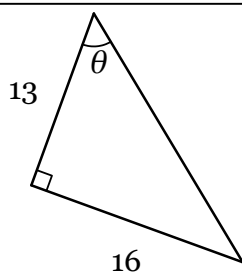
Name _____

Period _____

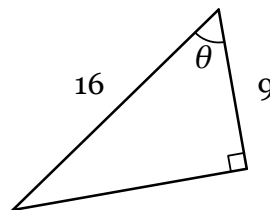
Date _____

Start at box 6. Find θ to the nearest degree. Pick one answer and go to the box it names. Write each box number in the row at the bottom as you go.

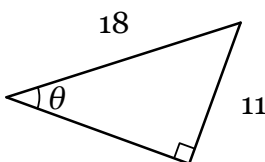
$\sin^{-1}(0.6)$ means the angle whose sine is 0.6. Name the ratio of the two sides you know: $\sin = \text{opposite} \div \text{hypotenuse}$, $\cos = \text{adjacent} \div \text{hypotenuse}$, $\tan = \text{opposite} \div \text{adjacent}$. Write it as a decimal. Then use the key. Calculator in degree mode.



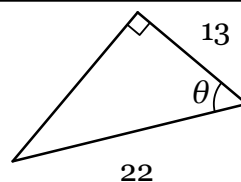
1 Find θ .
 $\theta = 51^\circ \rightarrow$ go to box 5
 $\theta = 39^\circ \rightarrow$ go to box 2
 Hint: Find θ first. Which leg touches it, and which leg is across from it?



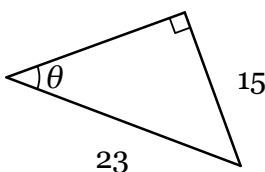
2 Find θ .
 $\theta = 34^\circ \rightarrow$ go to box 3
 $\theta = 56^\circ \rightarrow$ go to box 7
 Hint: Which corner holds θ ? Name each side from that corner.



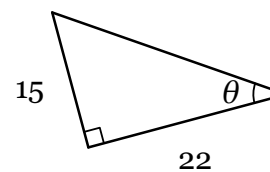
3 Find θ .
 $\theta = 38^\circ \rightarrow$ go to box 7
 $\theta = 52^\circ \rightarrow$ go to box 2
 Hint: Put a finger on the arc. Which side is across from it?



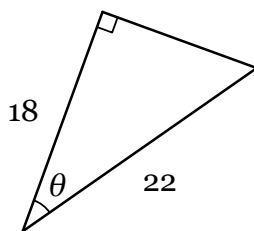
4 Find θ .
 $\theta = 54^\circ \rightarrow$ you are out
 $\theta = 36^\circ \rightarrow$ go to box 2
 Hint: Check the corner with the arc. Which leg touches that corner?



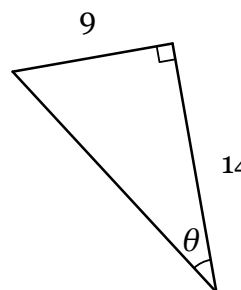
5 Find θ .
 $\theta = 33^\circ \rightarrow$ go to box 8
 $\theta = 41^\circ \rightarrow$ go to box 4
 Hint: Look for the hypotenuse among the two sides. Which ratio uses it with the opposite side?



6 Find θ .
 $\theta = 43^\circ \rightarrow$ go to box 8
 $\theta = 34^\circ \rightarrow$ go to box 3
 Hint: Look at the two sides with numbers. Does the hypotenuse have one?



7 Find θ .
 $\theta = 39^\circ \rightarrow$ go to box 8
 $\theta = 35^\circ \rightarrow$ go to box 1
 Hint: Which side touches θ , and which side is across from the right angle?



8 Find θ .
 $\theta = 33^\circ \rightarrow$ go to box 3
 $\theta = 40^\circ \rightarrow$ go to box 6
 Hint: Which ratio do the two sides make? Then choose its key.

Write every box number here, in order.

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The route, in order. Boxes 2 and 8 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table.

6 → 3 → 7 → 1 → 5 → 4 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 6 Find θ to the nearest degree. The sides are opposite 15 and adjacent 22.	34°. The 15 is opposite θ and the 22 is next to θ (adjacent), so they make the tangent: $15 \div 22 = 0.6818$, and $\tan^{-1}(0.6818) = 34.29^\circ$.	"43°" goes to box 8. $\sin^{-1}$ is pressed in place of $\tan^{-1}$: $\sin^{-1}(0.6818) = 42.99^\circ$.
2	Box 3 Find θ to the nearest degree. The sides are opposite 11 and hypotenuse 18.	38°. The 11 is opposite θ and the 18 is the hypotenuse, so they make the sine: $11 \div 18 = 0.6111$, and $\sin^{-1}(0.6111) = 37.67^\circ$.	"52°" goes to box 2. It is the other acute angle, $90^\circ - 38^\circ$. It comes from the wrong corner, or from $\cos^{-1}$ in place of $\sin^{-1}$.
3	Box 7 Find θ to the nearest degree. The sides are adjacent 18 and hypotenuse 22.	35°. The 18 is next to θ (adjacent) and the 22 is the hypotenuse, so they make the cosine: $18 \div 22 = 0.8182$, and $\cos^{-1}(0.8182) = 35.10^\circ$.	"39°" goes to box 8. $\tan^{-1}$ is pressed in place of $\cos^{-1}$: $\tan^{-1}(0.8182) = 39.29^\circ$.
4	Box 1 Find θ to the nearest degree. The sides are opposite 16 and adjacent 13.	51°. The 16 is opposite θ and the 13 is next to θ (adjacent), so they make the tangent: $16 \div 13 = 1.2308$, and $\tan^{-1}(1.2308) = 50.91^\circ$.	"39°" goes to box 2. It is the other acute angle, $90^\circ - 51^\circ$. It comes from the wrong corner, or from the fraction upside down.
5	Box 5 Find θ to the nearest degree. The sides are opposite 15 and hypotenuse 23.	41°. The 15 is opposite θ and the 23 is the hypotenuse, so they make the sine: $15 \div 23 = 0.6522$, and $\sin^{-1}(0.6522) = 40.71^\circ$.	"33°" goes to box 8. $\tan^{-1}$ is pressed in place of $\sin^{-1}$: $\tan^{-1}(0.6522) = 33.11^\circ$.
6	Box 4 Find θ to the nearest degree. The sides are adjacent 13 and hypotenuse 22.	54°. The 13 is next to θ (adjacent) and the 22 is the hypotenuse, so they make the cosine: $13 \div 22 = 0.5909$, and $\cos^{-1}(0.5909) = 53.78^\circ$.	"36°" goes to box 2. It is the other acute angle, $90^\circ - 54^\circ$. It comes from the wrong corner, or from $\sin^{-1}$ in place of $\cos^{-1}$.
	Box 2 Find θ to the nearest degree. The sides are adjacent 9 and hypotenuse 16.	56°. The 9 is next to θ (adjacent) and the 16 is the hypotenuse, so they make the cosine: $9 \div 16 = 0.5625$, and $\cos^{-1}(0.5625) = 55.77^\circ$.	"34°" goes to box 3. It is the other acute angle, $90^\circ - 56^\circ$. It comes from the wrong corner, or from $\sin^{-1}$ in place of $\cos^{-1}$.
	Box 8 Find θ to the nearest degree. The sides are opposite 9 and adjacent 14.	33°. The 9 is opposite θ and the 14 is next to θ (adjacent), so they make the tangent: $9 \div 14 = 0.6429$, and $\tan^{-1}(0.6429) = 32.74^\circ$.	"40°" goes to box 6. $\sin^{-1}$ is pressed in place of $\tan^{-1}$: $\sin^{-1}(0.6429) = 40.01^\circ$.

How to check any box. Stand at the corner marked θ . The side across from it is the opposite side, the leg that touches it is the adjacent side, and the side across from the right angle is the hypotenuse. The two sides with numbers decide the ratio. Divide, then use the matching key. The two acute angles add to 90° , so the wrong corner gives 90° minus θ .

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.