

SCAVENGER HUNT



USING TRIG RATIOS TO FIND A SIDE

Trig Ratios: Multiply or Divide?

Sine, cosine and tangent · x on top and x underneath · the cards check the answers

FREE

ANSWER

23.7

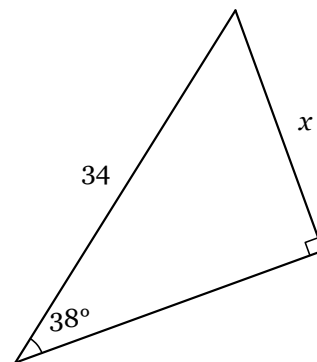
A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

A leg is always shorter than the hypotenuse. Is your answer?

R



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Scavenger Hunt — how to run it

a full class period

1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a *different* one of these eight cards: *R C F D G Q J L*.
2. **Say this once:** “Set your calculator to degrees. Sin 30 must show 0.5. Name the ratio and write the equation before you press a key. Round x to the nearest tenth, like 17.3. Then walk to the card with that answer at the top.”
3. **Each group writes one line per card.** Eight right answers bring the group back to its first card.

16 cards	pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.
Record sheet	page 11, one per student. It shows the three ratios on a labeled triangle.
Answers	pages 12–13, for you only. Do not put them up in the room.

Every card shows a right triangle drawn to scale, turned a different way. One acute angle is marked with its size. One side has its length, and the side marked x is the one to find. Students name each side from the marked angle: the opposite leg is across from it, the adjacent leg touches it, and the hypotenuse is across from the right angle. Then $\sin = \text{opposite} \div \text{hypotenuse}$, $\cos = \text{adjacent} \div \text{hypotenuse}$ and $\tan = \text{opposite} \div \text{adjacent}$. On four of the eight ring cards, x is underneath in the fraction, so the last step is a division. These are the hard ones.

Eight of the sixteen cards make the ring. A group reaches the other eight only by a wrong answer, but all the cards look the same. There are two mistakes. In the first, the student multiplies where the equation divides, or divides where it multiplies. In the second, the student mixes up opposite and adjacent, so cosine is used in place of sine or sine in place of cosine. Each of these lands on a card off the ring. That card sends the group back to the card it got wrong.

The check is the length of the group’s list. A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in italics under its question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. Guessing does not work: no single rule, such as always multiplying by the sine, gets more than four of the cards. If a group keeps coming back to the same cards, ask: “*Point to the marked angle. Which side is across from it? Is x on top of your fraction or underneath?*”



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

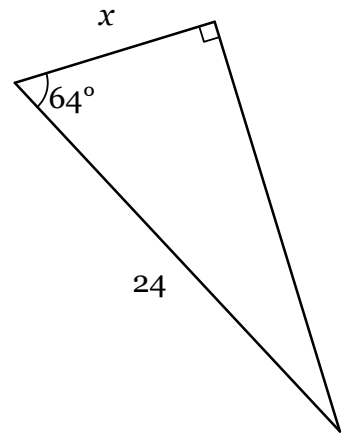
62.4

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Divide by the ratio when x is underneath. Multiply when x is on top.



A

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ANSWER

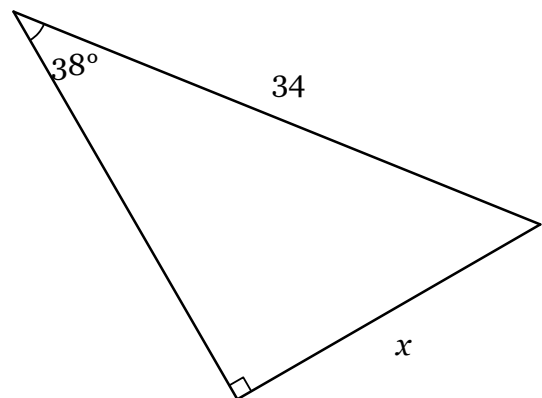
39.6

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Which side is across from the given angle? That side is the opposite.



B

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ANSWER

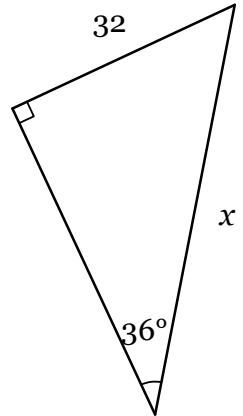
20.9

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Point to the given angle. The opposite side does not touch it.



C

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ANSWER

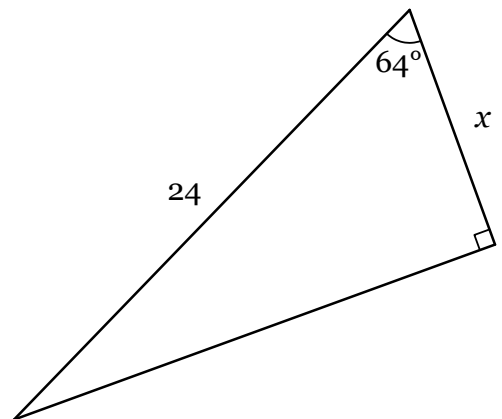
14.8

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

The adjacent leg touches the given angle. The hypotenuse is not a leg.



D

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ANSWER

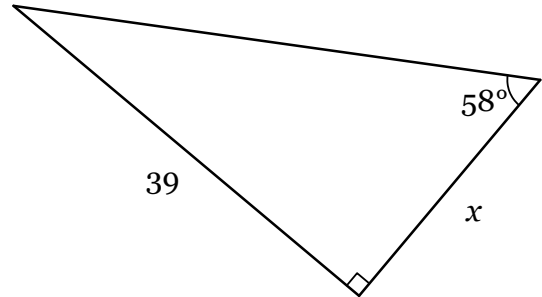
41.1

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Point to the given angle. Which leg runs from it to the right angle?



E

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ANSWER

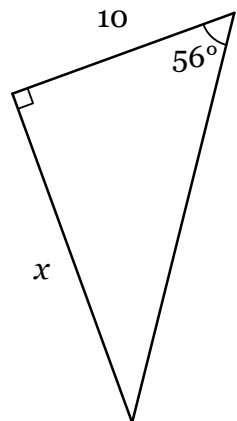
54.4

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Write the equation first. Is x on top of the fraction or underneath?



F

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ANSWER

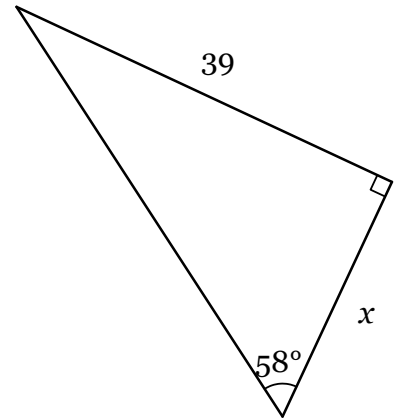
10.5

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

With x underneath, the final step is a division.



G

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ANSWER

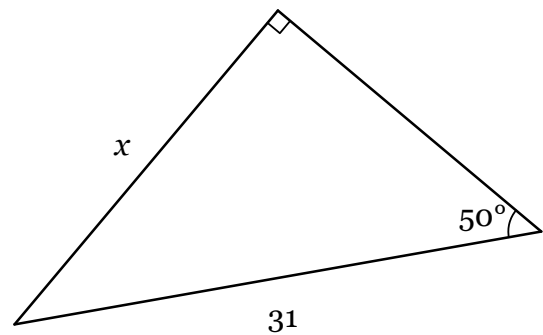
55.2

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Is x on top in your equation? Then the final step multiplies.



H

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ANSWER

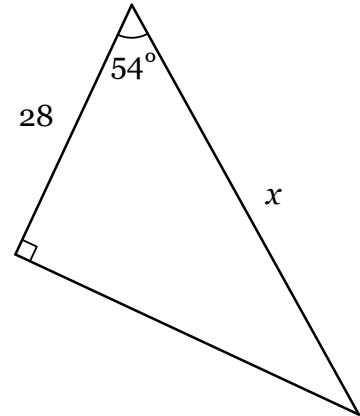
27.7

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

The hypotenuse is the longest side. Check it against the leg you have.



J

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ANSWER

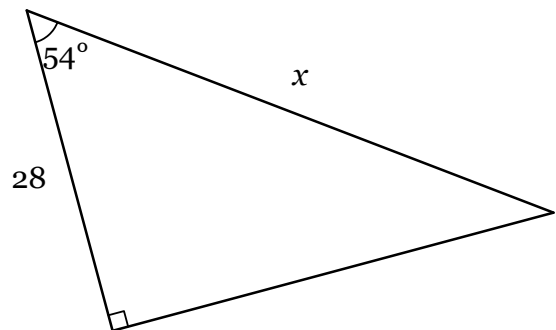
19.9

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Find the given angle first. Then name each side from that corner.



K

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ANSWER

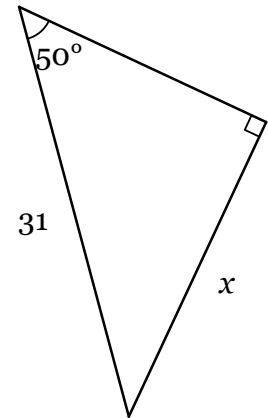
47.6

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Sin uses the side across from the given angle.



L

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ANSWER

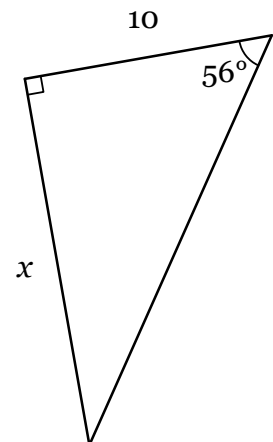
21.6

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Cos goes with the leg that touches the given angle.



M

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ANSWER

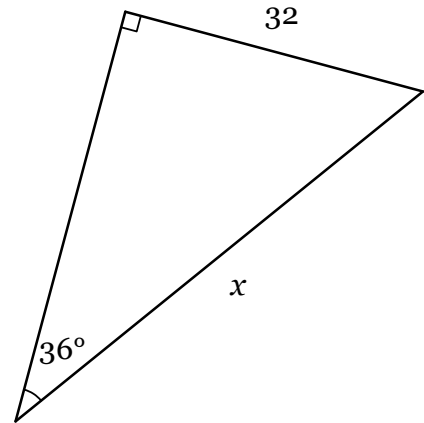
6.7

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

In tan, the opposite leg is on top. Where does x stand?



N

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ANSWER

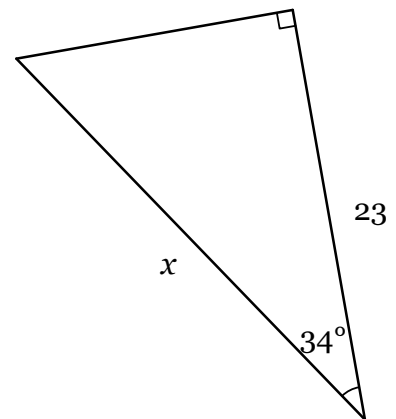
16.5

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Can a leg be longer than the hypotenuse? Check your answer.



P

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ANSWER

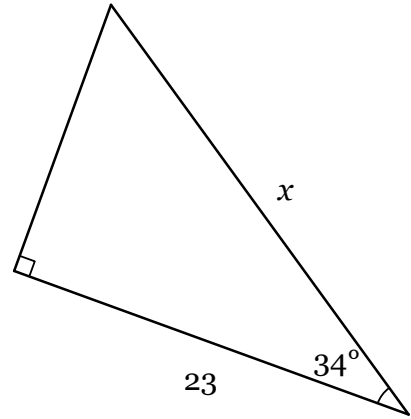
24.4

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

Which leg touches the given angle? Cos goes with that leg.



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Q

ANSWER

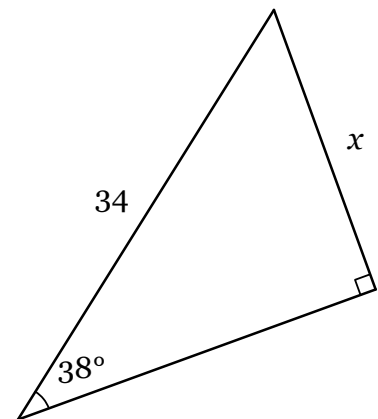
23.7

A right triangle. Use the given angle.

Find x .

Round x to the nearest tenth.

A leg is always shorter than the hypotenuse. Is your answer?



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R

Scavenger Hunt — where I went

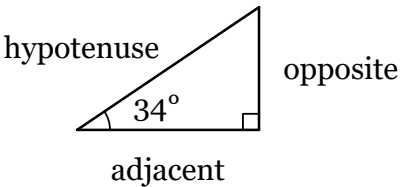
Trig ratios: find a side

Name _____

Period _____

Date _____

For each card, write the ratio, then the equation, then x . **Round x once, at the end, to the nearest tenth, like 17.3.** Then find the card with your answer at the top. A clean run is eight lines. Each card has a line in italics under its question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**



Name the sides from the given angle. $\sin = \text{opposite} \div \text{hypotenuse}$ · $\cos = \text{adjacent} \div \text{hypotenuse}$ · $\tan = \text{opposite} \div \text{adjacent}$

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.

Card letter	Ratio: sin, cos or tan	Equation	My answer for x
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

What does a math teacher write on a permission slip?

Every number stands for a letter. Write the letter for each answer in the box above its number. Read the boxes you filled, left to right. **If they do not spell the answer, one of your answers is wrong.**

6.7 = E 10.5 = S 14.8 = I 16.5 = E 19.9 = E 20.9 = N 21.6 = S 23.7 = E 24.4 = H 27.7 = E 39.6 = H 41.1 = N
 47.6 = R 54.4 = E 55.2 = R 62.4 = I

6.7	10.5	14.8	16.5	19.9	20.9	21.6	23.7	24.4	27.7	39.6	41.1	47.6	54.4	55.2	62.4



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Scavenger Hunt — answers

For the teacher

The ring in order, with the answer found on each card. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card.

R (20.9) → C (54.4) → F (14.8) → D (10.5) → G (24.4) → Q (27.7) → J (47.6) → L (23.7) → R

What does a math teacher write on a permission slip? The answer is *SINE HERE!* It is read along the boxes of the record sheet, which run from the smallest number to the largest. Every ratio below is the calculator's value in degree mode, to four places. The answer is rounded only at the end.

Card	The question on the card	Answer, and why	The common wrong answer on this card, and why	Letter of its top
1 R	A right triangle with a 38° angle. The hypotenuse is 34. Find x, the leg across from the 38° angle.	20.9. The 34 is across from the right angle, so it is the hypotenuse. x is across from the 38° angle, so it is the opposite leg. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 38^\circ = x \div 34$. x is on top, so multiply: $34 \times 0.6157 = 20.9$.	55.2. Dividing where the equation multiplies: $34 \div \sin 38^\circ = 55.2$. It is longer than the hypotenuse 34, and a leg never is.	E
2 C	A right triangle with a 36° angle. The leg across from the 36° angle is 32. Find x, the hypotenuse.	54.4. The 32 is across from the 36° 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 $\sin 36^\circ = 32 \div x$. x is underneath, so divide: $32 \div 0.5878 = 54.4$.	39.6. Opposite and adjacent swapped, so cos is used in place of sin: $32 \div \cos 36^\circ = 39.6$. Nothing in the arithmetic shows this mistake.	N
3 F	A right triangle with a 56° angle. The leg that touches the 56° angle is 10. Find x, the leg across from the 56° angle.	14.8. The 10 touches the 56° angle and is not the hypotenuse, so it is the adjacent leg. x is across from the 56° angle, so it is the opposite leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 56^\circ = x \div 10$. x is on top, so multiply: $10 \times 1.4826 = 14.8$.	6.7. Dividing where the equation multiplies: $10 \div \tan 56^\circ = 6.7$.	E
4 D	A right triangle with a 64° angle. The hypotenuse is 24. Find x, the leg that touches the 64° angle.	10.5. The 24 is across from the right angle, so it is the hypotenuse. x touches the 64° angle and is not the hypotenuse, so it is the adjacent leg. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 64^\circ = x \div 24$. x is on top, so multiply: $24 \times 0.4384 = 10.5$.	21.6. Opposite and adjacent swapped, so sin is used in place of cos: $24 \times \sin 64^\circ = 21.6$. Nothing in the arithmetic shows this mistake.	I
5 G	A right triangle with a 58° angle. The leg across from the 58° angle is 39. Find x, the leg that touches the 58° angle.	24.4. The 39 is across from the 58° angle, so it is the opposite leg. x touches the 58° angle and is not the hypotenuse, so it is the adjacent leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 58^\circ = 39 \div x$. x is underneath, so divide: $39 \div 1.6003 = 24.4$.	62.4. Multiplying where the equation divides: $39 \times \tan 58^\circ = 62.4$.	S
6 Q	A right triangle with a 34° angle. The leg that touches the 34° angle is 23. Find x, the hypotenuse.	27.7. The 23 touches the 34° 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 $\cos 34^\circ = 23 \div x$. x is underneath, so divide: $23 \div 0.8290 = 27.7$.	41.1. Opposite and adjacent swapped, so sin is used in place of cos: $23 \div \sin 34^\circ = 41.1$. Nothing in the arithmetic shows this mistake.	H
7 J	A right triangle with a 54° angle. The leg that touches the 54° angle is 28. Find x, the hypotenuse.	47.6. The 28 touches the 54° 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 $\cos 54^\circ = 28 \div x$. x is underneath, so divide: $28 \div 0.5878 = 47.6$.	16.5. Multiplying where the equation divides: $28 \times \cos 54^\circ = 16.5$. It is shorter than the leg 28, and the hypotenuse is the longest side.	E
8 L	A right triangle with a 50° angle. The hypotenuse is 31. Find x, the leg across from the 50° angle.	23.7. The 31 is across from the right angle, so it is the hypotenuse. x is across from the 50° angle, so it is the opposite leg. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 50^\circ = x \div 31$. x is on top, so multiply: $31 \times 0.7660 = 23.7$.	19.9. Opposite and adjacent swapped, so cos is used in place of sin: $31 \times \cos 50^\circ = 19.9$. Nothing in the arithmetic shows this mistake.	R

Scavenger Hunt — the cards off the ring

For the teacher

A group reaches these eight cards only by a wrong answer. The number at the top of each one is the wrong answer from one ring card. Its right answer is the number at the top of that ring card, so the group goes to the card it got wrong and tries it again. If the group makes the same mistake here, it goes to another card off the ring. So a second wrong answer never moves a group forward.

Card	The question on the card	Answer, and why	The common wrong answer on this card, and why	Letter of its top
H	A right triangle with a 50° angle. The hypotenuse is 31. Find x , the leg across from the 50° angle.	23.7. The 31 is across from the right angle, so it is the hypotenuse. x is across from the 50° angle, so it is the opposite leg. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 50^\circ = x \div 31$. x is on top, so multiply: $31 \times 0.7660 = 23.7$.	19.9. Opposite and adjacent swapped, so $\cos$ is used in place of $\sin$: $31 \times \cos 50^\circ = 19.9$. Nothing in the arithmetic shows this mistake.	R
B	A right triangle with a 38° angle. The hypotenuse is 34. Find x , the leg across from the 38° angle.	20.9. The 34 is across from the right angle, so it is the hypotenuse. x is across from the 38° angle, so it is the opposite leg. $\sin = \text{opposite} \div \text{hypotenuse}$, so $\sin 38^\circ = x \div 34$. x is on top, so multiply: $34 \times 0.6157 = 20.9$.	55.2. Dividing where the equation multiplies: $34 \div \sin 38^\circ = 55.2$. It is longer than the hypotenuse 34, and a leg never is.	H
N	A right triangle with a 36° angle. The leg across from the 36° angle is 32. Find x , the hypotenuse.	54.4. The 32 is across from the 36° 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 $\sin 36^\circ = 32 \div x$. x is underneath, so divide: $32 \div 0.5878 = 54.4$.	39.6. Opposite and adjacent swapped, so $\cos$ is used in place of $\sin$: $32 \div \cos 36^\circ = 39.6$. Nothing in the arithmetic shows this mistake.	E
M	A right triangle with a 56° angle. The leg that touches the 56° angle is 10. Find x , the leg across from the 56° angle.	14.8. The 10 touches the 56° angle and is not the hypotenuse, so it is the adjacent leg. x is across from the 56° angle, so it is the opposite leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 56^\circ = x \div 10$. x is on top, so multiply: $10 \times 1.4826 = 14.8$.	6.7. Dividing where the equation multiplies: $10 \div \tan 56^\circ = 6.7$.	S
A	A right triangle with a 64° angle. The hypotenuse is 24. Find x , the leg that touches the 64° angle.	10.5. The 24 is across from the right angle, so it is the hypotenuse. x touches the 64° angle and is not the hypotenuse, so it is the adjacent leg. $\cos = \text{adjacent} \div \text{hypotenuse}$, so $\cos 64^\circ = x \div 24$. x is on top, so multiply: $24 \times 0.4384 = 10.5$.	21.6. Opposite and adjacent swapped, so $\sin$ is used in place of $\cos$: $24 \times \sin 64^\circ = 21.6$. Nothing in the arithmetic shows this mistake.	I
E	A right triangle with a 58° angle. The leg across from the 58° angle is 39. Find x , the leg that touches the 58° angle.	24.4. The 39 is across from the 58° angle, so it is the opposite leg. x touches the 58° angle and is not the hypotenuse, so it is the adjacent leg. $\tan = \text{opposite} \div \text{adjacent}$, so $\tan 58^\circ = 39 \div x$. x is underneath, so divide: $39 \div 1.6003 = 24.4$.	62.4. Multiplying where the equation divides: $39 \times \tan 58^\circ = 62.4$.	N
P	A right triangle with a 34° angle. The leg that touches the 34° angle is 23. Find x , the hypotenuse.	27.7. The 23 touches the 34° 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 $\cos 34^\circ = 23 \div x$. x is underneath, so divide: $23 \div 0.8290 = 27.7$.	41.1. Opposite and adjacent swapped, so $\sin$ is used in place of $\cos$: $23 \div \sin 34^\circ = 41.1$. Nothing in the arithmetic shows this mistake.	E
K	A right triangle with a 54° angle. The leg that touches the 54° angle is 28. Find x , the hypotenuse.	47.6. The 28 touches the 54° 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 $\cos 54^\circ = 28 \div x$. x is underneath, so divide: $28 \div 0.5878 = 47.6$.	16.5. Multiplying where the equation divides: $28 \times \cos 54^\circ = 16.5$. It is shorter than the leg 28, and the hypotenuse is the longest side.	E

Other mistakes lead to no card. A group might mix up opposite and adjacent and also multiply where it should divide, use a calculator in radian mode, round the ratio to two places before the last step, or copy the given number. Its answer is then not the number at the top of any card.