LESSON MAKER PRO

Right Triangle Ratios

Use side positions to find sine, cosine, and tangent.

HIGH SCHOOL · HSG-SRT.C.6

CCSS.Math.Content.HSG-SRT.C.6 "Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles."

NAME _____ DATE _____

THE BIG IDEA

In a right triangle, choose an acute angle θ. sin θ = opposite/hypotenuse, cos θ = adjacent/hypotenuse, and tan θ = opposite/adjacent. These ratios depend on θ, so similar right triangles have the same ratios for matching angles.

WORKED EXAMPLE

In a right triangle, relative to acute angle θ, the opposite side is 8, the adjacent side is 15, and the hypotenuse is 17. Find sin θ, cos θ, and tan θ.

1. sin θ = opposite/hypotenuse = 8/17.
2. cos θ = adjacent/hypotenuse = 15/17.
3. tan θ = opposite/adjacent = 8/15.

Answer: sin θ = 8/17, cos θ = 15/17, tan θ = 8/15

PRACTICE 6 problems

1 In a right triangle, relative to acute angle θ, the opposite side is 3, the adjacent side is 4, and the hypotenuse is 5. Find sin θ, cos θ, and tan θ.

ANSWER _____

2 A right triangle has an opposite side of 7 and a hypotenuse of 25 relative to acute angle θ. Find sin θ.

ANSWER _____

3 A right triangle has a side of 9 adjacent to acute angle θ and a hypotenuse of 41. Find cos θ.

ANSWER _____

4 In a right triangle, the side opposite acute angle θ is 20 and the adjacent side is 21. Find tan θ.

ANSWER _____

5 In a right triangle, sin θ = 12/37. If the hypotenuse is 74, find the side opposite θ.

ANSWER _____

6 In a right triangle, relative to acute angle θ, the opposite side is 60, the adjacent side is 11, and the hypotenuse is 61. Find sin θ, cos θ, and tan θ.

ANSWER _____

APPLY IT Show your work

1 A school theater's safety cable runs from the floor to the top of a 40-foot support pole. The cable is 42 feet long and makes an acute angle θ with the floor. What is sin θ in simplest form?

WORK SPACE

ANSWER _____

2 A skate park ramp rises 18 inches over a horizontal run of 24 inches. Its straight surface is 30 inches long. The ramp makes an acute angle θ with the level ground. Find sin θ, cos θ, and tan θ.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A right triangle has side lengths, relative to acute angle θ, of 7 opposite, 24 adjacent, and 25 for the hypotenuse. A similar right triangle has the matching angle θ and an opposite side of 35. Find its adjacent side and hypotenuse. Explain why tan θ is unchanged.

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ANSWER KEY

Right Triangle Ratios

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	In a right triangle, relative to acute angle θ, the opposite side is 3, the adjacent side is 4, and the hypotenuse is 5. Find sin θ, cos θ, and tan θ.	**sin θ = 3/5, cos θ = 4/5, tan θ = 3/4**
2	A right triangle has an opposite side of 7 and a hypotenuse of 25 relative to acute angle θ. Find sin θ.	**7/25**
3	A right triangle has a side of 9 adjacent to acute angle θ and a hypotenuse of 41. Find cos θ.	**9/41**
4	In a right triangle, the side opposite acute angle θ is 20 and the adjacent side is 21. Find tan θ.	**20/21**
5	In a right triangle, sin θ = 12/37. If the hypotenuse is 74, find the side opposite θ.	**24**
6	In a right triangle, relative to acute angle θ, the opposite side is 60, the adjacent side is 11, and the hypotenuse is 61. Find sin θ, cos θ, and tan θ.	**sin θ = 60/61, cos θ = 11/61, tan θ = 60/11**

PART 2 · APPLY IT

1. **20/21** For the angle at the floor, the pole is opposite θ and the cable is the hypotenuse. sin θ = 40/42 = 20/21.
2. **sin θ = 3/5, cos θ = 4/5, tan θ = 3/4** The rise is opposite θ, the horizontal run is adjacent to θ, and the ramp surface is the hypotenuse. Use 18/30, 24/30, and 18/24, then simplify.

CHALLENGE

Adjacent side = 120 and hypotenuse = 125. The scale factor is 5, so tan θ = 35/120 = 7/24, the same as in the original triangle.

Accept equivalent fractions, although simplified forms are shown. For problems asking for all three ratios, accept the ratios in any clear order if each is correctly labeled.