

Right Triangle Trigonometry & Rationalizing Fractions

Trigonometry Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Rationalize fractions by eliminating radicals from the denominator
- Identify the opposite, adjacent, and hypotenuse sides of a right triangle relative to a given reference angle
- Apply the six trigonometric ratios (sin, cos, tan, csc, sec, cot) using SOH-CAH-TOA and its reciprocals

Problems

1. Rationalize the denominator of the fraction shown below.

$$\frac{1}{\sqrt{2}}$$

2. Rationalize the denominator of the fraction shown below.

$$\frac{5}{\sqrt{5}}$$

3. Rationalize the denominator of the fraction shown below.

$$\frac{4}{\sqrt{3}}$$

4. A right triangle has a hypotenuse of 10, an opposite side of 6, and an adjacent side of 8 relative to angle A. Find $\sin(A)$ and $\cos(A)$.

5. Using the right triangle with opposite = 5, adjacent = 12, and hypotenuse = 13 relative to angle B, find $\tan(B)$ and $\cot(B)$.

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6. For angle C in a right triangle where opposite = 7, adjacent = 24, and hypotenuse = 25, find all six trigonometric ratios.

7. Rationalize the denominator and simplify the expression shown below.

$$\frac{6}{\sqrt{12}}$$

8. A right triangle has angle A at the top-left corner. The side opposite to A has length $\sqrt{3}$, the adjacent side has length 1, and the hypotenuse has length 2. Find $\csc(A)$ and $\sec(A)$, then rationalize any radical denominators in your answers.

9. In a right triangle, $\sin(A) = 3$ divided by the square root of 34, and $\cos(A) = 5$ divided by the square root of 34. Rationalize both expressions and then find $\tan(A)$ and $\cot(A)$.

$$\sin(A) = \frac{3}{\sqrt{34}}, \quad \cos(A) = \frac{5}{\sqrt{34}}$$

10. A right triangle has legs of length 1 and 1, giving a hypotenuse of the square root of 2. Using angle A opposite to one of the legs, find all six trig ratios and rationalize any answers that contain a radical in the denominator.

$$\text{legs} = 1, 1; \quad \text{hypotenuse} = \sqrt{2}$$

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Right Triangle Trigonometry & Rationalizing Fractions — Answer Key

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Answer Key

1. Answer: $\sqrt{2} / 2$

- Multiply numerator and denominator by $\sqrt{2}$: $(1 \cdot \sqrt{2}) / (\sqrt{2} \cdot \sqrt{2})$
 - Denominator becomes $\sqrt{4} = 2$
 - Result: $\sqrt{2} / 2$
-

2. Answer: $\sqrt{5}$

- Multiply numerator and denominator by $\sqrt{5}$: $(5 \cdot \sqrt{5}) / (\sqrt{5} \cdot \sqrt{5})$
 - Denominator becomes $\sqrt{25} = 5$
 - Result: $5\sqrt{5} / 5 = \sqrt{5}$
-

3. Answer: $4\sqrt{3} / 3$

- Multiply numerator and denominator by $\sqrt{3}$: $(4 \cdot \sqrt{3}) / (\sqrt{3} \cdot \sqrt{3})$
 - Denominator becomes $\sqrt{9} = 3$
 - Result: $4\sqrt{3} / 3$ (cannot simplify further)
-

4. Answer: $\sin(A) = 3/5$, $\cos(A) = 4/5$

- $\sin(A) = \text{opposite} / \text{hypotenuse} = 6 / 10 = 3/5$
 - $\cos(A) = \text{adjacent} / \text{hypotenuse} = 8 / 10 = 4/5$
-

5. Answer: $\tan(B) = 5/12$, $\cot(B) = 12/5$

- $\tan(B) = \text{opposite} / \text{adjacent} = 5 / 12$
 - $\cot(B)$ is the reciprocal of $\tan(B) = \text{adjacent} / \text{opposite} = 12 / 5$
-

6. Answer: $\sin=7/25$, $\cos=24/25$, $\tan=7/24$, $\csc=25/7$, $\sec=25/24$, $\cot=24/7$

- $\sin(C) = \text{opp/hyp} = 7/25$
 - $\cos(C) = \text{adj/hyp} = 24/25$
 - $\tan(C) = \text{opp/adj} = 7/24$
 - $\csc(C) = \text{hyp/opp} = 25/7$
 - $\sec(C) = \text{hyp/adj} = 25/24$
 - $\cot(C) = \text{adj/opp} = 24/7$
-

7. Answer: $\sqrt{3}$

- Multiply numerator and denominator by $\sqrt{12}$: $(6\sqrt{12}) / (\sqrt{12} \cdot \sqrt{12})$
 - Denominator becomes 12
 - Result: $6\sqrt{12} / 12 = \sqrt{12} / 2$
 - Simplify $\sqrt{12} = 2\sqrt{3}$, so $(2\sqrt{3}) / 2 = \sqrt{3}$
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8. Answer: $\csc(A) = 2\sqrt{3}/3$, $\sec(A) = 2$

- $\csc(A) = \text{hyp/opp} = 2/\sqrt{3}$
 - Rationalize: $(2 \cdot \sqrt{3}) / (\sqrt{3} \cdot \sqrt{3}) = 2\sqrt{3} / 3$
 - $\sec(A) = \text{hyp/adj} = 2/1 = 2$ (no rationalization needed)
-

9. Answer: $\sin(A)=3\sqrt{34}/34$, $\cos(A)=5\sqrt{34}/34$, $\tan(A)=3/5$, $\cot(A)=5/3$

- Rationalize $\sin(A)$: $(3 \cdot \sqrt{34}) / (\sqrt{34} \cdot \sqrt{34}) = 3\sqrt{34} / 34$
 - Rationalize $\cos(A)$: $(5 \cdot \sqrt{34}) / (\sqrt{34} \cdot \sqrt{34}) = 5\sqrt{34} / 34$
 - $\tan(A) = \sin(A)/\cos(A) = (3/\sqrt{34}) \div (5/\sqrt{34}) = 3/5$
 - $\cot(A) = 1/\tan(A) = 5/3$
-

10. Answer: $\sin=\sqrt{2}/2$, $\cos=\sqrt{2}/2$, $\tan=1$, $\csc=\sqrt{2}$, $\sec=\sqrt{2}$, $\cot=1$

- opp = 1, adj = 1, hyp = $\sqrt{2}$
 - $\sin(A) = 1/\sqrt{2} \rightarrow \text{rationalize} \rightarrow \sqrt{2}/2$
 - $\cos(A) = 1/\sqrt{2} \rightarrow \text{rationalize} \rightarrow \sqrt{2}/2$
 - $\tan(A) = 1/1 = 1$
 - $\csc(A) = \sqrt{2}/1 = \sqrt{2}$
 - $\sec(A) = \sqrt{2}/1 = \sqrt{2}$
 - $\cot(A) = 1/1 = 1$
-

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