Solving Right Triangles Using SOHCAHTOA

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Name: ______________________________ Date: _______________ Score: / 10

Learning Objectives

- Apply SOH-CAH-TOA to find missing sides of right triangles
- Use inverse trigonometric functions to find missing acute angles
- Evaluate the six trigonometric functions for special angles such as pi/3

Solve each right triangle by finding all missing sides and angles; round side lengths to two decimal places when needed.

1. Find the length of the hypotenuse x of the right triangle with a 30° angle whose adjacent leg measures 12.

Answer: ________________________________

2. Find the length of the side opposite the 45° angle in a right triangle whose hypotenuse is 10.

Answer: ________________________________

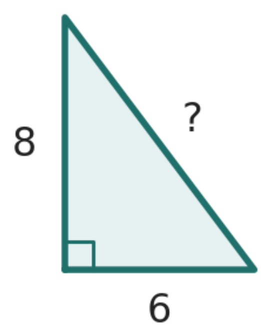
3. A right triangle has a 60° angle with an opposite leg of length 9. Find the length of the adjacent leg.

Answer: ________________________________

4. Find the missing acute angle θ in a right triangle whose opposite side is 7 and hypotenuse is 14.

Answer: ________________________________

5. Find the hypotenuse of a right triangle whose legs measure 6 and 8 using the Pythagorean Theorem, then verify sin θ for the angle opposite the leg of length 6.



Answer: ________________________________

6. In a right triangle, the adjacent side to angle θ is 5 and the hypotenuse is 13. Find θ to the nearest degree.

Answer: ________________________________

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7. Evaluate the six trigonometric functions of θ = π/3 (60°).

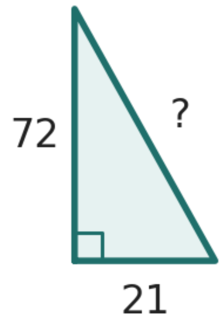
$$\theta = \frac{\pi}{3}$$

Answer: ____

8. A right triangle has angle A = 25° and the side opposite A measures 18. Find the hypotenuse.

Answer: ____

9. For the right triangle with legs 21 and 72, find the hypotenuse and then sin and cos of the angle opposite the leg of length 21.



Answer: ____

10. Find the missing acute angle and the missing side: a right triangle has hypotenuse 20 and one acute angle 35°. Find the side opposite 35° and the remaining acute angle.

Answer: ____

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ANSWER KEY & SOLUTIONS

Remind students to identify the opposite, adjacent, and hypotenuse relative to the reference angle before choosing sine, cosine, or tangent.

Solutions

1. Find the length of the hypotenuse x of the right triangle with a 30° angle whose adjacent leg measures 12.

→ *Identify the 12 as adjacent to the 30° angle and x as the hypotenuse.*
→ *Use cosine: cos(30°) = adjacent / hypotenuse = 12 / x.*
→ *Solve for x: x = 12 / cos(30°).*
→ *Since cos(30°) = √3/2, x = 24/√3 = 8√3 ≈ 13.86.*

Answer: $x = \dfrac{12}{\cos 30^\circ} = 8\sqrt{3} \approx 13.86$

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2. Find the length of the side opposite the 45° angle in a right triangle whose hypotenuse is 10.

→ *The unknown side is opposite the 45° angle and 10 is the hypotenuse.*
→ *Use sine: sin(45°) = opposite / hypotenuse = y / 10.*
→ *Solve: y = 10 · sin(45°).*
→ *sin(45°) = √2/2, so y = 5√2 ≈ 7.07.*

Answer: $y = 10 \sin 45^\circ = 5\sqrt{2} \approx 7.07$

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3. A right triangle has a 60° angle with an opposite leg of length 9. Find the length of the adjacent leg.

→ *Label 9 as opposite and x as adjacent to the 60° angle.*
→ *Use tangent: tan(60°) = opposite / adjacent = 9 / x.*
→ *Solve: x = 9 / tan(60°).*
→ *Since tan(60°) = √3, x = 9/√3 = 3√3 ≈ 5.20.*

Answer: $x = \dfrac{9}{\tan 60^\circ} = 3\sqrt{3} \approx 5.20$

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4. Find the missing acute angle θ in a right triangle whose opposite side is 7 and hypotenuse is 14.

→ *Use sine since opposite and hypotenuse are given: sin(θ) = 7/14.*
→ *Simplify: sin(θ) = 1/2.*
→ *Take the inverse sine: θ = sin■^{1}(1/2).*
→ *Therefore θ = 30°.*

Answer: $\theta = \sin^{-1}\left(\dfrac{7}{14}\right) = 30^\circ$

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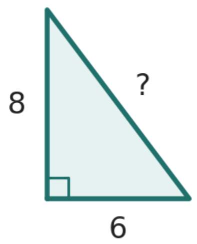
5. Find the hypotenuse of a right triangle whose legs measure 6 and 8 using the Pythagorean Theorem, then verify sin θ for the angle opposite the leg of length 6.



→ *Apply the Pythagorean Theorem: $c^2 = 6^2 + 8^2 = 36 + 64 = 100$.*
→ *So c = √100 = 10.*
→ *For the angle opposite the leg of 6: sin(θ) = opposite / hypotenuse = 6/10 = 3/5.*

Answer: $$c = 10,\ \sin\theta = \frac{6}{10} = \frac{3}{5}$$

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6. In a right triangle, the adjacent side to angle θ is 5 and the hypotenuse is 13. Find θ to the nearest degree.

→ *Use cosine: cos(θ) = adjacent / hypotenuse = 5/13.*
→ *Take the inverse cosine: θ = $\cos^{-1}$(5/13).*
→ *Compute: θ ≈ 67.38°, or about 67°.*

Answer: $$\theta = \cos^{-1}\left(\frac{5}{13}\right) \approx 67.38^\circ$$

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7. Evaluate the six trigonometric functions of θ = π/3 (60°).

$\theta = \frac{\pi}{3}$

→ *Use the 30-60-90 reference triangle with sides 1, √3, 2 (opposite, adjacent, hypotenuse for 60°).*
→ *sin(60°) = opposite/hypotenuse = √3/2; cos(60°) = adjacent/hypotenuse = 1/2.*
→ *tan(60°) = opposite/adjacent = √3/1 = √3.*
→ *Take reciprocals: csc(60°) = 2/√3 = 2√3/3, sec(60°) = 2, cot(60°) = 1/√3 = √3/3.*

Answer: $$\sin\theta = \frac{\sqrt{3}}{2},\ \cos\theta = \frac{1}{2},\ \tan\theta = \sqrt{3},\ \csc\theta = \frac{2\sqrt{3}}{3},\ \sec\theta = 2,\ \cot\theta = \frac{\sqrt{3}}{3}$$

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8. A right triangle has angle A = 25° and the side opposite A measures 18. Find the hypotenuse.

→ *Use sine: sin(25°) = opposite / hypotenuse = 18 / c.*
→ *Solve: c = 18 / sin(25°).*
→ *Compute sin(25°) ≈ 0.4226, so c ≈ 18 / 0.4226 ≈ 42.59.*

Answer: $$c = \frac{18}{\sin 25^\circ} \approx 42.59$$

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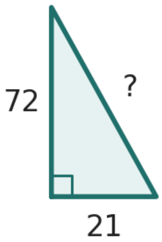
9. For the right triangle with legs 21 and 72, find the hypotenuse and then sin and cos of the angle opposite the leg of length 21.



→ *Apply Pythagorean Theorem: $c^2 = 21^2 + 72^2 = 441 + 5184 = 5625$.*

→ *Take the square root: $c = \sqrt{5625} = 75$.*

→ *For angle θ opposite the leg of 21: sin(θ) = 21/75 = 7/25, cos(θ) = 72/75 = 24/25.*

Answer: $c = 75,\ \sin\theta = \frac{21}{75} = \frac{7}{25},\ \cos\theta = \frac{72}{75} = \frac{24}{25}$

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10. Find the missing acute angle and the missing side: a right triangle has hypotenuse 20 and one acute angle 35°. Find the side opposite 35° and the remaining acute angle.

→ *The two acute angles must sum to 90°, so the other angle is 90° – 35° = 55°.*

→ *Use sine to find the side opposite 35°: sin(35°) = a / 20.*

→ *Solve: a = 20 · sin(35°) ≈ 20 · 0.5736 ≈ 11.47.*

Answer: $a = 20\sin 35^\circ \approx 11.47,\ \text{other angle} = 55^\circ$