

Missing Sides and Angles of a Right Triangle

Name: _____ Date: _____ Score: _____ / 28

Q Quick Review

Solving a right triangle means filling in every missing side and angle. The strategy is short: figure out which ratio connects what you have to what you want, then apply it.

Got an acute angle and one side, want another side? Use \sin , \cos , or \tan – whichever has both “the side you have” and “the side you want” in its definition.

If you have θ and the hypotenuse, want opposite: use $\sin \theta$.

If you have θ and the hypotenuse, want adjacent: use $\cos \theta$.

If you have θ and a leg, want the other leg: use $\tan \theta$.

Got two sides, want an acute angle? Use the inverse trig that matches the ratio you can form: \sin^{-1} , \cos^{-1} , or \tan^{-1} . Make sure your calculator is in *degree mode*.

Got two sides, want the third side? Use Pythagoras: $a^2 + b^2 = c^2$. No trig needed.

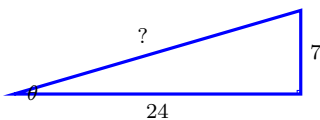
The free 90. Both acute angles sum to 90° . If one is 40° , the other is 50° – no calculator work required. Always do this last (it’s free).

Common slips. Plugging into \sin when you wanted \cos (double-check which leg is adjacent to the angle you’re using). Forgetting the hypotenuse is always the longest side – if your computation gives a “hypotenuse” shorter than one of the legs, you used the wrong ratio. Using radian mode by accident – $\sin 30$ in radians is about -0.99 , very different from 0.5 .

PRACTICE

Find each missing measure. Round side lengths to two decimal places and angles to the nearest degree unless otherwise noted.

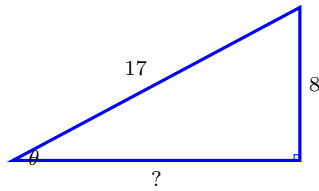
1. Right triangle, hypotenuse 20, acute angle 30° . Side opposite the 30° angle? _____
2. Right triangle, hypotenuse 14, acute angle 60° . Side adjacent to the 60° angle? _____
3. In a right triangle, opposite = 5, hyp = 10. Find the acute angle θ to the nearest degree. _____
4. Right triangle, angle $\theta = 35^\circ$, adjacent = 8. Find the opposite side (round to 2 decimals). _____
5. Right triangle, $\theta = 30^\circ$, opposite = 9. Find the hypotenuse. _____
6. Right triangle, legs 6 and 11. Find the larger acute angle (nearest degree). _____
7. Right triangle, hypotenuse 25, acute angle 40° . Find the other acute angle. _____
8. Right triangle, $\theta = 52^\circ$, adjacent = 10. Express the hypotenuse. _____
9. A ramp rises 4 feet over 18 horizontal feet. Find the angle of elevation (nearest degree). _____
10. Find the hypotenuse of the right triangle below. _____



11. Right triangle, $\theta = 45^\circ$, hypotenuse $\sqrt{2}$. Find each leg. _____
12. Right triangle, opposite = 7, adjacent = 24. Find θ (nearest degree). _____
13. Right triangle, $\theta = 50^\circ$, opposite = 12. Find the hypotenuse (nearest hundredth). _____



14. In the right triangle below, the side opposite θ is 8 and the hypotenuse is 17. Find the adjacent side. _____



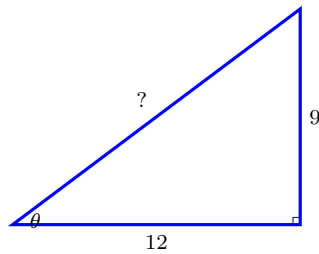
15. Right triangle, $\theta = 25^\circ$, hypotenuse 30. Find the opposite side (nearest hundredth). _____

16. Right triangle, two legs both 5. Find each acute angle. _____

17. Right triangle, $\theta = 60^\circ$, hypotenuse 10. Find the adjacent side. _____

18. Right triangle, $\theta = 60^\circ$, hypotenuse 10. Find the opposite side (exact). _____

19. In the right triangle below, the side opposite θ is 9 and the adjacent side is 12. Find the hypotenuse. _____



20. Right triangle, opposite = 1, adjacent = $\sqrt{3}$. Find θ exactly. _____

◆ Word Problems

21. A 20-foot guy wire is attached to a tower and anchored to the ground 12 feet from the base. What angle does the wire make with the ground? Round to the nearest degree. _____

22. From a lighthouse 80 feet above sea level, the angle of depression to a boat is 12° . How far is the boat from the base of the lighthouse? Round to the nearest foot. _____

23. A kite has 200 feet of string out and the string makes an angle of 40° with the ground. How high is the kite above the ground (assume the string is straight)? Round to the nearest tenth of a foot. _____

24. A right triangular sail has a vertical mast of 12 feet and a horizontal boom of 16 feet. Find the angle at the top of the mast (between the mast and the diagonal hypotenuse). Round to the nearest degree. _____

Additional Practice

25. Find $\sin \theta$ if opposite = 5, hypotenuse = 13. _____

26. Find $\cos \theta$ if adjacent = 12, hypotenuse = 13. _____

27. Find $\tan \theta$ if opposite = 7, adjacent = 4. _____

28. Find $\sin 30^\circ$. _____



Answer Keys

1. 10	13. ≈ 15.66
2. 7	14. 15
3. 30°	15. ≈ 12.68
4. ≈ 5.60	16. 45°
5. 18	17. 5
6. ≈ 61°	18. 5√3
7. 50°	19. 15
8. $\frac{10}{\cos 52^\circ}$	20. 30°
9. ≈ 13°	21. ≈ 53°
10. 25	22. ≈ 376 ft
11. 1	23. ≈ 128.6 ft
12. ≈ 16°	24. ≈ 53°
Additional Practice Answers	
25. $\frac{5}{13}$	27. $\frac{7}{4}$
26. $\frac{12}{13}$	28. $\frac{1}{2}$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

- A careful way to see it: $\sin 30^\circ = \frac{\text{opp}}{20} = \frac{1}{2}$, so opp = 10. This is the part to check before moving on, because it keeps the answer tied to the original question.
- Keep the rule visible: $\cos 60^\circ = \frac{\text{adj}}{14} = \frac{1}{2}$, so adj = 7. This is the part to check before moving on, because it keeps the answer tied to the original question.
- One steady path is: $\sin \theta = \frac{5}{10} = \frac{1}{2}$, so $\theta = 30^\circ$ (an exact special-angle hit). This is the part to check before moving on, because it keeps the answer tied to the original question.
- Start with the key idea: $\tan 35^\circ = \frac{\text{opp}}{8}$, so opp = $8 \tan 35^\circ \approx 8(0.7002) \approx 5.60$. This is the part to check before moving on, because it keeps the answer tied to the original question.
- A careful way to see it: $\sin 30^\circ = \frac{9}{h} = \frac{1}{2}$, so $h = 18$. This is the part to check before moving on, because it keeps the answer tied to the original question.
- Keep the rule visible: Larger acute angle is opposite the longer leg. $\tan \theta = \frac{11}{6} \approx 1.833$, so $\theta \approx 61^\circ$. That gives a quick check on the answer.
- One steady path is: Acute angles sum to 90° : $90^\circ - 40^\circ = 50^\circ$. This is the part to check before moving on, because it keeps the answer tied to the original question.
- You have the angle and its adjacent leg and want the hypotenuse, so use cosine: $\cos 52^\circ = \frac{10}{h}$, giving $h = \frac{10}{\cos 52^\circ} \approx 16.24$. The hypotenuse is the longest side, so an answer above 10 is the right ballpark.
- A careful way to see it: $\tan \theta = \frac{4}{18} \approx 0.222$, so $\theta \approx 13^\circ$. This is the part to check before moving on, because it keeps the answer tied to the original question.
- Keep the rule visible: $h = \sqrt{7^2 + 24^2} = \sqrt{625} = 25$. (A 7-24-25 Pythagorean triple.) That gives a quick check on the answer.
- In a 45-45-90, legs are equal and hyp = leg·√2. Here $\sqrt{2} = \text{leg} \cdot \sqrt{2}$, so leg = 1.
- Start with the key idea: $\tan \theta = \frac{7}{24}$, so $\theta = \arctan \frac{7}{24} \approx 16.26^\circ \approx 16^\circ$. This is the part to check before moving on, because it keeps the answer tied to the original question.
- A careful way to see it: $\sin 50^\circ = \frac{12}{h}$, so $h = \frac{12}{\sin 50^\circ} \approx \frac{12}{0.766} \approx 15.66$.

- This is the part to check before moving on, because it keeps the answer tied to the original question.
- Keep the rule visible: $\text{adj} = \sqrt{17^2 - 8^2} = \sqrt{225} = 15$. (An 8-15-17 Pythagorean triple.) That gives a quick check on the answer.
 - One steady path is: $\sin 25^\circ = \frac{\text{opp}}{30}$, so opp = $30 \sin 25^\circ \approx 30(0.4226) \approx 12.68$. This is the part to check before moving on, because it keeps the answer tied to the original question.
 - Equal legs mean a 45-45-90 triangle. Both acute angles are 45° . (Or: $\tan \theta = \frac{5}{5} = 1$, so $\theta = 45^\circ$.)
 - A careful way to see it: $\cos 60^\circ = \frac{\text{adj}}{10} = \frac{1}{2}$, so adj = 5. This is the part to check before moving on, because it keeps the answer tied to the original question.
 - Keep the rule visible: $\sin 60^\circ = \frac{\text{opp}}{10} = \frac{\sqrt{3}}{2}$, so opp = $5\sqrt{3} \approx 8.66$. This is the part to check before moving on, because it keeps the answer tied to the original question.
 - One steady path is: $h = \sqrt{9^2 + 12^2} = \sqrt{225} = 15$. (Another 3-4-5 scaled by 3.) That gives a quick check on the answer.
 - Start with the key idea: $\tan \theta = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$, which matches $\tan 30^\circ$. This is the part to check before moving on, because it keeps the answer tied to the original question.
 - Adjacent = 12, hyp = 20. $\cos \theta = \frac{12}{20} = \frac{3}{5} = 0.6$, so $\theta = \arccos 0.6 \approx 53.13^\circ \approx 53^\circ$. (Sanity: this is the angle in a 3-4-5 adjacent to the side of 3.)
 - Angle of depression from the top equals the angle of elevation from the boat. With the lighthouse height 80 opposite the 12° angle: $\tan 12^\circ = \frac{80}{d}$, so $d = \frac{80}{\tan 12^\circ} \approx \frac{80}{0.2126} \approx 376$ feet.
 - String is the hypotenuse, height is opposite the 40° angle. $\sin 40^\circ = \frac{h}{200}$, so $h = 200 \sin 40^\circ \approx 200(0.6428) \approx 128.6$ feet.
 - At the top of the mast, the opposite side is the 16-foot boom and the adjacent side is the 12-foot mast. $\tan \theta = \frac{16}{12} = \frac{4}{3} \approx 1.333$, so $\theta = \arctan \frac{4}{3} \approx 53.13^\circ \approx 53^\circ$. (This is the classic 3-4-5 triangle scaled by 4.)



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