

Trigonometry Review

Trigonometric Ratios

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} \quad \cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

Part A — Reading a Right Triangle

For this question, consider right triangle ABC , where $\angle C = 90^\circ$.

1. a) If $\angle A$ is the reference angle, identify:
 - a) the opposite side
 - b) the adjacent side
 - c) the hypotenuse
- b) If $\angle B$ is now the reference angle, identify:
 - a) the opposite side
 - b) the adjacent side
 - c) the hypotenuse
- c) Explain why the opposite and adjacent sides change when the reference angle changes, but the hypotenuse does not.

Part B — Choosing a Trigonometric Ratio

For each question, choose the appropriate trigonometric ratio and determine the missing value.

2. A right triangle has a reference angle of 38° and a hypotenuse of 20 cm. Find the opposite side.
3. A right triangle has a reference angle of 52° and an adjacent side of 14 m. Find the hypotenuse.
4. A right triangle has a reference angle of 27° and an adjacent side of 18 m. Find the opposite side.
5. A right triangle has an opposite side of 9.4 cm and a hypotenuse of 15.8 cm. Find the reference angle.
6. A right triangle has an adjacent side of 12.5 m and a hypotenuse of 20.0 m. Find the reference angle.
7. A right triangle has an opposite side of 17.2 m and an adjacent side of 23.6 m. Find the reference angle.

Part C — Right-Triangle Problems

8. A flagpole casts a 16.0 m shadow when the angle of elevation of the Sun is 37° . Determine the height of the flagpole.
9. A 7.5 m ladder rests against a vertical wall. The foot of the ladder is 2.0 m from the wall. Determine the angle the ladder makes with the ground.
10. A guy wire is attached to the top of a 12 m pole. The wire makes an angle of 58° with the ground. How far from the base of the pole should the wire be anchored?

11. An airplane is 850 m above the ground. The angle of depression from the airplane to an airport is 4° . Determine the horizontal distance from the airplane to the airport.
12. A road rises 18 m for every 240 m of horizontal distance. Determine the angle the road makes with the horizontal.

Part D — Putting Triangles Together

13. 15. A person is standing 30 m from a building. The angle of elevation to the roof is 34° . An antenna extends above the roof, and the angle of elevation to the top of the antenna is 41° . Determine the height of the antenna.
14. Two people stand on the same side of a 25 m tower. The angle of elevation to the top of the tower is 55° for the closer person and 38° for the farther person. How far apart are the two people?
15. An asymmetric roof has a vertical height of 4.5 m. The left side of the roof makes an angle of 42° with the horizontal and the right side makes an angle of 31° with the horizontal. Determine the total width of the building.
16. A pipe must rise 2.4 m to pass over an obstruction. On one side, the pipe rises at 60° . On the other side, it descends at 45° . The horizontal section across the top of the obstruction is 3.0 m. Determine the total length of pipe required to travel around the obstruction.

Part E — Model the Situation

17. A student stands 24 m from the base of a tree. The angle of elevation from the student to the top of the tree is 36° . The student's eye level is 1.6 m above the ground. Determine the height of the tree.
18. From the top of a 32 m cliff, the angle of depression to a boat is 18° . Determine how far the boat is horizontally from the base of the cliff.
19. A person standing on level ground observes the top of a tower at an angle of elevation of 28° . After walking 35 m directly toward the tower, the angle of elevation is 41° . Determine the height of the tower.
20. A building has a peaked roof. From a point 18 m from the building, the angle of elevation to the edge of the roof is 29° , while the angle of elevation to the peak is 37° . Determine how much higher the peak is than the edge of the roof.
21. A cable must run from the ground to the top of a vertical pole, then from the top of the pole to another point on the ground. The ground anchors are 14 m and 20 m from the base of the pole. The first cable makes an angle of 54° with the ground. Determine the **total length of cable required**.