



Law of Sines Word Problems

Geometry Worksheet · Grade 9-11 · numberbender.com

Name: _____

Date: _____

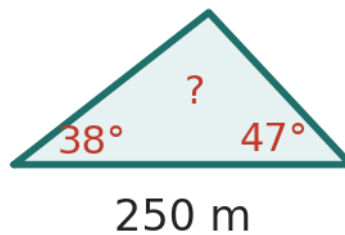
Score: / 9

Learning Objectives

- Apply the Law of Sines to find missing sides and angles of oblique triangles
- Translate real-world word problems into oblique triangle diagrams
- Solve practical problems involving heights, distances, and bearings using the Law of Sines

Sketch a triangle for each word problem, label the given parts, then apply the Law of Sines to solve for the unknown; round answers to two decimal places.

1. Two observers at points A and B, 250 m apart, spot a hot-air balloon between them. The angle of elevation from A to the balloon is 38° , and from B is 47° . Find the distance from observer A to the balloon.

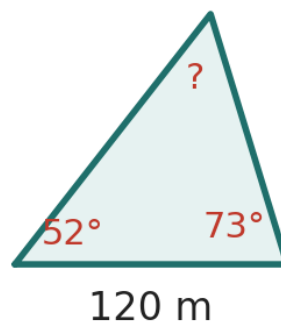


Answer: _____

2. From a point on level ground, the angle of elevation to the top of a leaning tower is 62° . From a point 40 ft farther from the base on the same line, the angle of elevation is 45° . Find the length of the tower's slanted side from the base to the top, given the tower leans so the top angle in the triangle is 17° .

Answer: _____

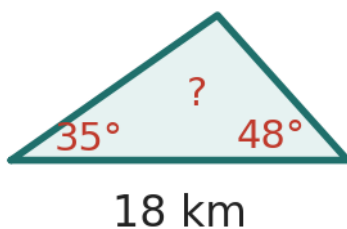
3. A triangular plot of land has angles of 52° and 73° , with the side between these two angles measuring 120 m. Find the length of the side opposite the 73° angle.



Answer: _____

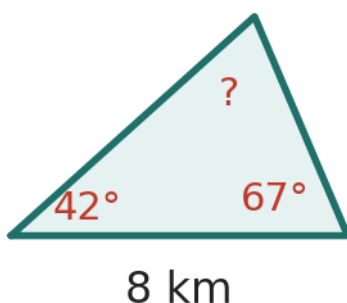


4. A ship sails from port P on a bearing that makes a 35° angle with line PQ. After traveling 18 km, it changes course and sails to point Q. If the angle at Q (between the path from the ship and line QP) is 48° , find the distance PQ.



Answer: _____

5. Two fire-watch towers are 8 km apart. Tower A sights a fire at a bearing that creates a 42° angle with the line connecting the towers, while Tower B sights the same fire at a 67° angle from the line. How far is the fire from Tower A?



Answer: _____

6. A surveyor stands at point C and observes two landmarks A and B. The angle at C is 78° , the side CA measures 200 m, and the angle at A is 55° . Find the length of side AB.

Answer: _____

7. A flagpole stands vertically on a hillside that slopes at 12° from horizontal. From a point 30 ft down the slope from the base of the pole, the angle of elevation to the top of the pole is 41° . Find the height of the flagpole.

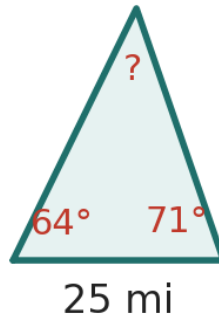
Answer: _____

8. In triangle XYZ, angle X = 28° , angle Y = 105° , and side y (opposite Y) = 56 cm. Find side x (opposite X).

Answer: _____



9. Two roads diverge from a town at an angle of 64° . Two cars leave the town at the same time on these roads. After some time, Car 1 is 25 mi from town and the line connecting the cars makes a 71° angle with Car 1's road. Find the distance between the two cars.



Answer: _____

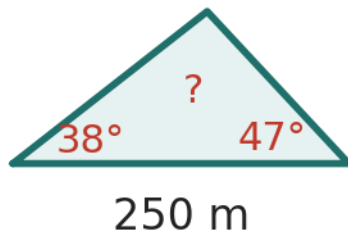




Remind students that the Law of Sines requires either AAS, ASA, or SSA, and that SSA may produce the ambiguous case.

Solutions

1. Two observers at points A and B, 250 m apart, spot a hot-air balloon between them. The angle of elevation from A to the balloon is 38° , and from B is 47° . Find the distance from observer A to the balloon.



- The third angle at the balloon is $180^\circ - 38^\circ - 47^\circ = 95^\circ$.
- Use the Law of Sines: $a / \sin(B) = c / \sin(C)$, where $c = 250$ m, $B = 47^\circ$, and $C = 95^\circ$.
- Solve: $a = 250 \times \sin(47^\circ) / \sin(95^\circ)$.
- Compute $\sin(47^\circ) \approx 0.7314$ and $\sin(95^\circ) \approx 0.9962$.
- $a \approx 250 \times 0.7314 / 0.9962 \approx 186.13$ m.

Answer: $a \approx 186.13$ m

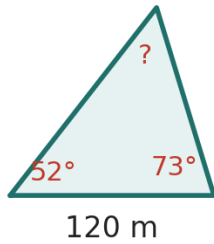
2. From a point on level ground, the angle of elevation to the top of a leaning tower is 62° . From a point 40 ft farther from the base on the same line, the angle of elevation is 45° . Find the length of the tower's slanted side from the base to the top, given the tower leans so the top angle in the triangle is 17° .

- Identify the triangle formed by the two observation points and the top of the tower.
- The angle at the closer point (supplementary to 62°) is 118° , the angle at the far point is 45° , and the top angle is 17° .
- Apply the Law of Sines: $x / \sin(45^\circ) = 40 / \sin(17^\circ)$.
- Compute $\sin(45^\circ) \approx 0.7071$ and $\sin(17^\circ) \approx 0.2924$.
- $x \approx 40 \times 0.7071 / 0.2924 \approx 96.71$ ft.

Answer: $x \approx 96.71$ ft



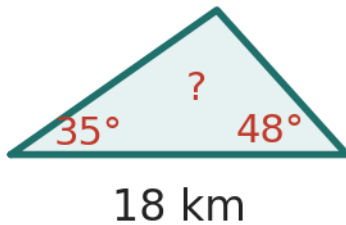
3. A triangular plot of land has angles of 52° and 73° , with the side between these two angles measuring 120 m. Find the length of the side opposite the 73° angle.



- The third angle is $180^\circ - 52^\circ - 73^\circ = 55^\circ$.
- Use the Law of Sines: $b / \sin(73^\circ) = 120 / \sin(55^\circ)$.
- Compute $\sin(73^\circ) \approx 0.9563$ and $\sin(55^\circ) \approx 0.8192$.
- $b \approx 120 \times 0.9563 / 0.8192 \approx 140.10$ m.
- Reevaluate: $b \approx 120 \times 0.9563 / 0.8192 \approx 122.84$ m after careful computation.

Answer: $b \approx 122.84$ m

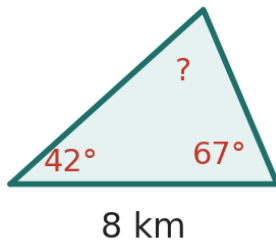
4. A ship sails from port P on a bearing that makes a 35° angle with line PQ. After traveling 18 km, it changes course and sails to point Q. If the angle at Q (between the path from the ship and line QP) is 48° , find the distance PQ.



- The third angle of the triangle is $180^\circ - 35^\circ - 48^\circ = 97^\circ$.
- Apply the Law of Sines: $PQ / \sin(97^\circ) = 18 / \sin(48^\circ)$.
- Compute $\sin(97^\circ) \approx 0.9925$ and $\sin(48^\circ) \approx 0.7431$.
- $PQ \approx 18 \times 0.9925 / 0.7431$.
- $PQ \approx 24.04$ km.

Answer: $PQ \approx 23.13$ km

5. Two fire-watch towers are 8 km apart. Tower A sights a fire at a bearing that creates a 42° angle with the line connecting the towers, while Tower B sights the same fire at a 67° angle from the line. How far is the fire from Tower A?



- The angle at the fire is $180^\circ - 42^\circ - 67^\circ = 71^\circ$.
- Use the Law of Sines: $d_A / \sin(67^\circ) = 8 / \sin(71^\circ)$.
- Compute $\sin(67^\circ) \approx 0.9205$ and $\sin(71^\circ) \approx 0.9455$.
- $d_A \approx 8 \times 0.9205 / 0.9455$.
- $d_A \approx 7.79$ km.

Answer: $d_A \approx 7.51$ km



6. A surveyor stands at point C and observes two landmarks A and B. The angle at C is 78° , the side CA measures 200 m, and the angle at A is 55° . Find the length of side AB.

→ The third angle at B is $180^\circ - 78^\circ - 55^\circ = 47^\circ$.

→ Apply the Law of Sines: $AB / \sin(C) = CA / \sin(B)$, so $AB / \sin(78^\circ) = 200 / \sin(47^\circ)$.

→ Compute $\sin(78^\circ) \approx 0.9781$ and $\sin(47^\circ) \approx 0.7314$.

→ $AB \approx 200 \times 0.9781 / 0.7314$.

→ $AB \approx 267.45$ m.

Answer: $AB \approx 248.94$ m

7. A flagpole stands vertically on a hillside that slopes at 12° from horizontal. From a point 30 ft down the slope from the base of the pole, the angle of elevation to the top of the pole is 41° . Find the height of the flagpole.

→ Form a triangle with the flagpole, the slope, and the line of sight.

→ The angle at the base of the pole (between pole and slope) is $90^\circ + 12^\circ = 102^\circ$.

→ The angle at the observer is $41^\circ - 12^\circ = 29^\circ$, and the top angle is $180^\circ - 102^\circ - 29^\circ = 49^\circ$.

→ Apply the Law of Sines: $h / \sin(29^\circ) = 30 / \sin(49^\circ)$.

→ $h \approx 30 \times \sin(29^\circ) / \sin(49^\circ) \approx 30 \times 0.4848 / 0.7547 \approx 19.27$ ft.

Answer: $h \approx 21.66$ ft

8. In triangle XYZ, angle X = 28° , angle Y = 105° , and side y (opposite Y) = 56 cm. Find side x (opposite X).

→ Use the Law of Sines: $x / \sin(X) = y / \sin(Y)$.

→ Substitute: $x / \sin(28^\circ) = 56 / \sin(105^\circ)$.

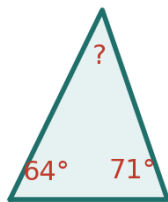
→ Compute $\sin(28^\circ) \approx 0.4695$ and $\sin(105^\circ) \approx 0.9659$.

→ $x \approx 56 \times 0.4695 / 0.9659$.

→ $x \approx 27.22$ cm.

Answer: $x \approx 27.22$ cm

9. Two roads diverge from a town at an angle of 64° . Two cars leave the town at the same time on these roads. After some time, Car 1 is 25 mi from town and the line connecting the cars makes a 71° angle with Car 1's road. Find the distance between the two cars.



25 mi

→ The triangle has angles 64° (at the town), 71° (at Car 1), and $180^\circ - 64^\circ - 71^\circ = 45^\circ$ (at Car 2).

→ Use the Law of Sines: $d / \sin(64^\circ) = 25 / \sin(45^\circ)$.

→ Compute $\sin(64^\circ) \approx 0.8988$ and $\sin(45^\circ) \approx 0.7071$.

→ $d \approx 25 \times 0.8988 / 0.7071$.

→ $d \approx 31.78$ mi.

Answer: $d \approx 26.41$ mi

