Law of Sines

Trigonometry Worksheet · Grade 10–12

Name: ________________________________ Date: ___________________

Learning Objectives

- Identify corresponding angles and opposite sides in oblique triangles
- Set up and solve Law of Sines proportions to find missing sides and angles
- Apply the Law of Sines to real-world oblique triangle problems

Problems

1. In triangle ABC, angle A = 40°, angle B = 60°, and side a = 10. Set up the Law of Sines proportion to find side b. (Do not solve yet — just write the proportion.)

$$\frac{a}{\sin A} = \frac{b}{\sin B} \quad \Rightarrow \quad \frac{10}{\sin 40°} = \frac{b}{\sin 60°}$$

2. In triangle ABC, angle A = 30°, angle B = 70°, and side a = 8. Find angle C.

$$A + B + C = 180°$$

3. In triangle ABC, angle A = 50°, angle B = 80°, and side a = 15 cm. Use the Law of Sines to find side b.

$$\frac{15}{\sin 50°} = \frac{b}{\sin 80°}$$

4. In triangle ABC, angle A = 110°, side a = 125 inches, and side b = 100 inches. Use the Law of Sines to find angle B.

$$\frac{125}{\sin 110°} = \frac{100}{\sin B}$$

5. In triangle ABC, angle A = 110°, side a = 125 inches, and side b = 100 inches. Using your answer from Problem 4 (B ≈ 48.57°), find angle C.

$$C = 180° - 110° - 48.57°$$

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6. Continuing from Problems 4 and 5, with angle A = 110°, side a = 125 inches, B ≈ 48.57°, and C ≈ 21.43°, use the Law of Sines to find side c.

$$\frac{125}{\sin 110°} = \frac{c}{\sin 21.43°}$$

7. In triangle ABC, angle B = 65°, angle C = 55°, and side b = 22 m. Find sides a and c using the Law of Sines.

$$\frac{22}{\sin 65°} = \frac{a}{\sin A} = \frac{c}{\sin 55°}$$

8. Two rangers at stations A and B, which are 12 km apart, both observe a fire at point C. Ranger A measures angle A = 52° and ranger B measures angle B = 61°. Use the Law of Sines to find the distance from station A to the fire (side b, opposite angle B).

$$\frac{12}{\sin C} = \frac{b}{\sin 61°}$$

9. In triangle ABC, side a = 30, side b = 45, and angle A = 38°. Use the Law of Sines to find angle B, then determine how many valid triangles exist (check for the ambiguous case).

$$\sin B = \frac{b \cdot \sin A}{a} = \frac{45 \cdot \sin 38°}{30}$$

10. A surveyor needs to find the length of a lake. From point A, she measures angle A = 73° to point C across the lake and walks 980 m to point B where she measures angle B = 55°. Point C is the far end of the lake on the opposite shore. Use the Law of Sines to find the distance AC (side b), which represents the length across the lake.

$$\frac{980}{\sin C} = \frac{b}{\sin B} \quad \text{where } C = 180° - 73° - 55°$$

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Law of Sines — Answer Key

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Answer Key

1. Answer: 10 / sin(40°) = b / sin(60°)

- Identify the known angle-side pair: angle A = 40°, side a = 10.
- Identify the unknown: side b opposite angle B = 60°.
- Write the proportion: 10 / sin(40°) = b / sin(60°).

2. Answer: C = 80°

- Use the triangle angle sum property: A + B + C = 180°.
- 30° + 70° + C = 180°.
- C = 180° – 100° = 80°.

3. Answer: b ≈ 19.33 cm

- Set up the proportion: 15 / sin(50°) = b / sin(80°).
- Cross multiply: b = 15 × sin(80°) / sin(50°).
- b = 15 × 0.9848 / 0.7660 ≈ 19.33 cm.

4. Answer: B ≈ 48.57°

- Set up the proportion: 125 / sin(110°) = 100 / sin(B).
- Cross multiply: sin(B) = 100 × sin(110°) / 125.
- sin(B) = 100 × 0.9397 / 125 ≈ 0.7518.
- B = arcsin(0.7518) ≈ 48.57°.

5. Answer: C ≈ 21.43°

- Use the angle sum: A + B + C = 180°.
- 110° + 48.57° + C = 180°.
- C = 180° – 158.57° ≈ 21.43°.

6. Answer: c ≈ 48.74 inches

- Set up the proportion: 125 / sin(110°) = c / sin(21.43°).
- Cross multiply: c = 125 × sin(21.43°) / sin(110°).
- c = 125 × 0.3652 / 0.9397 ≈ 48.74 inches.

7. Answer: a ≈ 6.74 m, c ≈ 19.89 m

- First find angle A: A = 180° – 65° – 55° = 60°.
- Set up for side a: a = 22 × sin(60°) / sin(65°) = 22 × 0.8660 / 0.9063 ≈ 6.74 m.
- Set up for side c: c = 22 × sin(55°) / sin(65°) = 22 × 0.8192 / 0.9063 ≈ 19.89 m.

8. Answer: b ≈ 13.21 km

- Find angle C: C = 180° – 52° – 61° = 67°.
- Set up the proportion: 12 / sin(67°) = b / sin(61°).

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- b = 12 × sin(61°) / sin(67°) = 12 × 0.8746 / 0.9205 ≈ 11.40 km.
- Wait — side b is opposite angle B = 61°, and side c (AB = 12 km) is opposite angle C = 67°.
- b = 12 × sin(61°) / sin(67°) ≈ 11.40 km.

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9. Answer: B ≈ 67.48° or B ≈ 112.52°; two valid triangles exist

- Compute sin(B) = 45 × sin(38°) / 30 = 45 × 0.6157 / 30 ≈ 0.9236.
- B■ = arcsin(0.9236) ≈ 67.48°.
- B■ = 180° – 67.48° = 112.52°.
- Check B■: A + B■ = 38° + 67.48° = 105.48° < 180° ✓ — valid.
- Check B■: A + B■ = 38° + 112.52° = 150.52° < 180° ✓ — also valid.
- Therefore two triangles exist (ambiguous SSA case).

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10. Answer: AC ≈ 857.67 m

- Find angle C: C = 180° – 73° – 55° = 52°.
- Side AB = 980 m is opposite angle C = 52°.
- Side AC = b is opposite angle B = 55°.
- Set up: 980 / sin(52°) = b / sin(55°).
- b = 980 × sin(55°) / sin(52°) = 980 × 0.8192 / 0.7880 ≈ 1018.56 m.
- AC ≈ 1018.56 m (distance from A to C across the lake).

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