Triangle Signal Lab

Use sine and cosine rules to measure any triangle.

HIGH SCHOOL · HSG-SRT.D.11

CCSS.Math.Content.HSG-SRT.D.11 "(+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces)."

NAME ______________________ DATE ____________

CHOOSE THE RIGHT RULE

Use the Law of Cosines when you know two sides and their included angle, or when you know all three sides: c^2 = a^2 + b^2 - 2ab cos C. Use the Law of Sines when you know an angle and its opposite side: a/sin A = b/sin B = c/sin C. Match each side with the angle directly across from it.

WORKED EXAMPLE

In a triangle, sides a = 7 and b = 11 include angle C = 45°. Find c exactly.

1. c^2 = 7^2 + 11^2 - 2(7)(11)cos 45°
2. c^2 = 49 + 121 - 154(sqrt2/2)
3. c^2 = 170 - 77sqrt2
4. c = sqrt(170 - 77sqrt2)

Answer: c = sqrt(170 - 77sqrt2)

PRACTICE 6 problems

1 Sides a = 6 and b = 8 include angle C = 60°. Find c exactly.

ANSWER ______________________

2 Two sides of a triangle are 10 and 10, and the included angle is 120°. Find the third side exactly.

ANSWER ______________________

3 In triangle ABC, A = 30°, a = 9, and B = 90°. Find b.

ANSWER ______________________

4 In triangle ABC, A = 60°, a = 6sqrt3, and B = 30°. Find b.

ANSWER ______________________

5 A triangle has side lengths 13, 15, and 17. Let C be the angle opposite the side of length 17. Find cos C.

ANSWER ______________________

6 In triangle ABC, A = 30°, a = 12, and B = 60°. Find b exactly.

ANSWER ______________________

APPLY IT Show your work

1 An environmental club maps two trail markers, P and Q, from a water station B. Marker P is 18 m from B, marker Q is 24 m from B, and angle PBQ is 60°. How far apart are P and Q? Give an exact answer.

WORK SPACE

ANSWER ______________________

2 A student videographer uses two marked spots A and B to frame a soccer goal at C. Triangle ABC has angle A = 30°, angle B = 60°, and AB = 20 m. Find AC exactly.

WORK SPACE

ANSWER ______________________

CHALLENGE One step up

CHALLENGE

In triangle ABC, A = 30°, a = 5, and b = 5sqrt3. How many different triangles are possible? Give the possible values of C and c. Explain briefly.

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Sides a = 6 and b = 8 include angle C = 60°. Find c exactly.	**c = 2sqrt13**
2	Two sides of a triangle are 10 and 10, and the included angle is 120°. Find the third side exactly.	**10sqrt3**
3	In triangle ABC, A = 30°, a = 9, and B = 90°. Find b.	**b = 18**
4	In triangle ABC, A = 60°, a = 6sqrt3, and B = 30°. Find b.	**b = 6**
5	A triangle has side lengths 13, 15, and 17. Let C be the angle opposite the side of length 17. Find cos C.	**cos C = 7/26**
6	In triangle ABC, A = 30°, a = 12, and B = 60°. Find b exactly.	**b = 12sqrt3**

PART 2 · APPLY IT

1. **PQ = 6sqrt13 m** Use the Law of Cosines with the two distances and their included 60° angle. PQ^2 = 18^2 + 24^2 - 2(18)(24)cos 60° = 468, so PQ = 6sqrt13 m.
2. **AC = 10sqrt3 m** First, angle C = 90°, so AB is opposite 90°. Apply the Law of Sines: AC/sin 60° = 20/sin 90°, giving AC = 10sqrt3 m.

CHALLENGE

Two triangles are possible: (C, c) = (90°, 10) or (30°, 5). Since sin B = (b sin A)/a = sqrt3/2, B can be 60° or 120°.

Accept equivalent exact radical forms and correctly simplified unsimplified radical forms. For the challenge, accept either order of the two possible triangles if both are given with a valid sine-based explanation.