LESSON MAKER PRO

Triangle Route Finder

Find exact lengths and angles without a calculator.

HIGH SCHOOL · A2S.GM.B.38

A2S.GM.B.38 "Derive and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles. Extend the domain of sine and cosine to include right and obtuse angles."

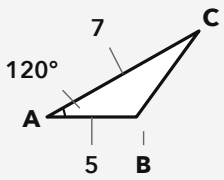
NAME _____ DATE _____

CHOOSE A TRIANGLE LAW

When you know two sides and the angle between them, use the Law of Cosines: $a^2 = b^2 + c^2 - 2bc \cos A$, where side a is opposite angle A. When you know an angle and its opposite side, use the Law of Sines: $a/\sin A = b/\sin B$. For an obtuse angle, sine is positive; $\sin 90° = 1$ and $\cos 90° = 0$.

WORKED EXAMPLE

Find BC in the triangle.

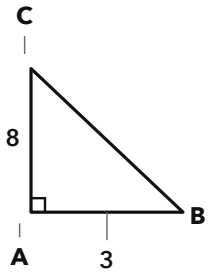


1. Use the Law of Cosines with the two sides next to angle A.
2. $BC^2 = 5^2 + 7^2 - 2(5)(7)\cos 120°$.
3. Since $\cos 120° = -1/2$, $BC^2 = 25 + 49 + 35 = 109$.

Answer: BC = sqrt(109)

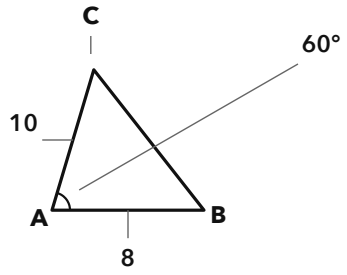
PRACTICE 6 problems

1 Find BC.



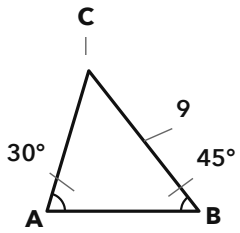
ANSWER _____

2 Find BC.



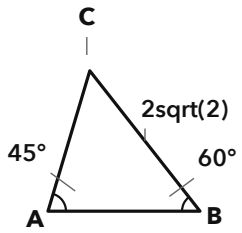
ANSWER _____

3 Find AC.



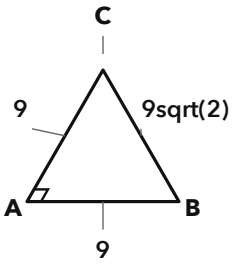
ANSWER _____

4 Find AC.



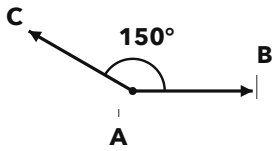
ANSWER _____

5 Use the Law of Cosines to find angle A.



ANSWER _____

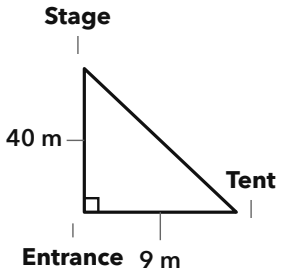
6 Find the sine and cosine of the marked angle.



ANSWER _____

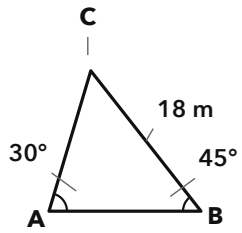
APPLY IT Show your work

1 At a music festival, paths from the entrance lead to the merch tent and the stage. Use the marked distances and angle to find the straight-line distance from the tent to the stage, in meters.



ANSWER _____

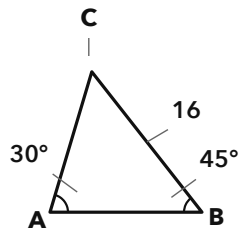
2 At a skate park, A, B, and C mark three viewing spots. Use the marked route and angles to find the straight-line distance from A to C, in meters.



ANSWER _____

CHALLENGE One step up

Find the exact perimeter of the triangle. Show how you find both missing sides.



WORK SPACE AND ANSWER

ANSWER KEY

Triangle Route Finder

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find BC.	**sqrt(73)**
2	Find BC.	**2sqrt(21)**
3	Find AC.	**9sqrt(2)**
4	Find AC.	**2sqrt(3)**
5	Use the Law of Cosines to find angle A.	**90°**
6	Find the sine and cosine of the marked angle.	**sin 150° = 1/2; cos 150° = -sqrt(3)/2**

PART 2 · APPLY IT

1. **41 m** The Law of Cosines at a right angle gives $d^2 = 9^2 + 40^2 = 1681$, so d = 41 m.
2. **18sqrt(2) m** By the Law of Sines, AC/sin 45° = 18/sin 30°. Thus AC = 18sqrt(2) m.

CHALLENGE

AC = 16sqrt(2) and AB = 8(sqrt(6) + sqrt(2)); perimeter = 16 + 24sqrt(2) + 8sqrt(6)

Accept equivalent exact radical expressions. In the challenge, angle C is 105° and sin 105° = (sqrt(6) + sqrt(2))/4.