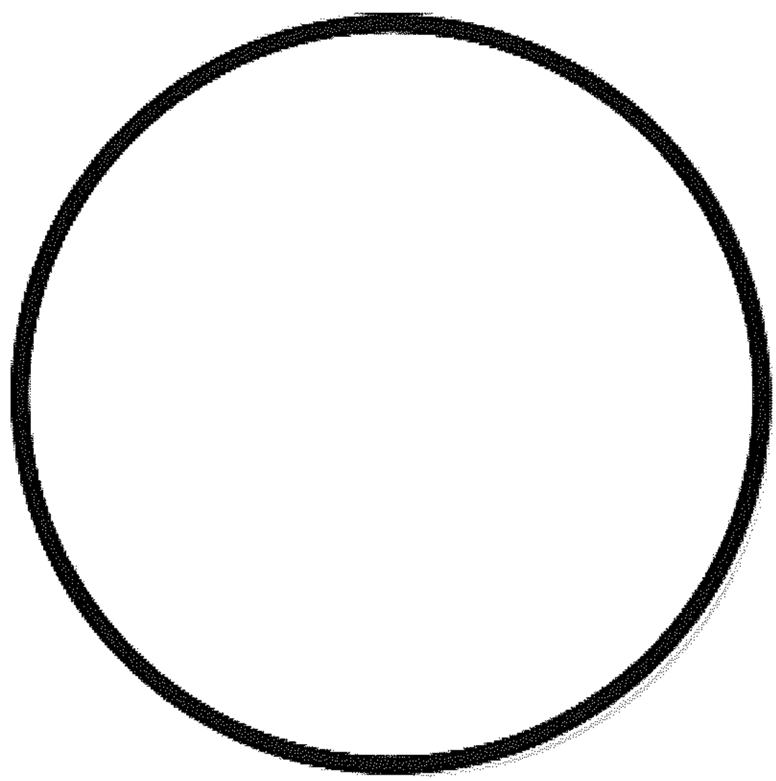
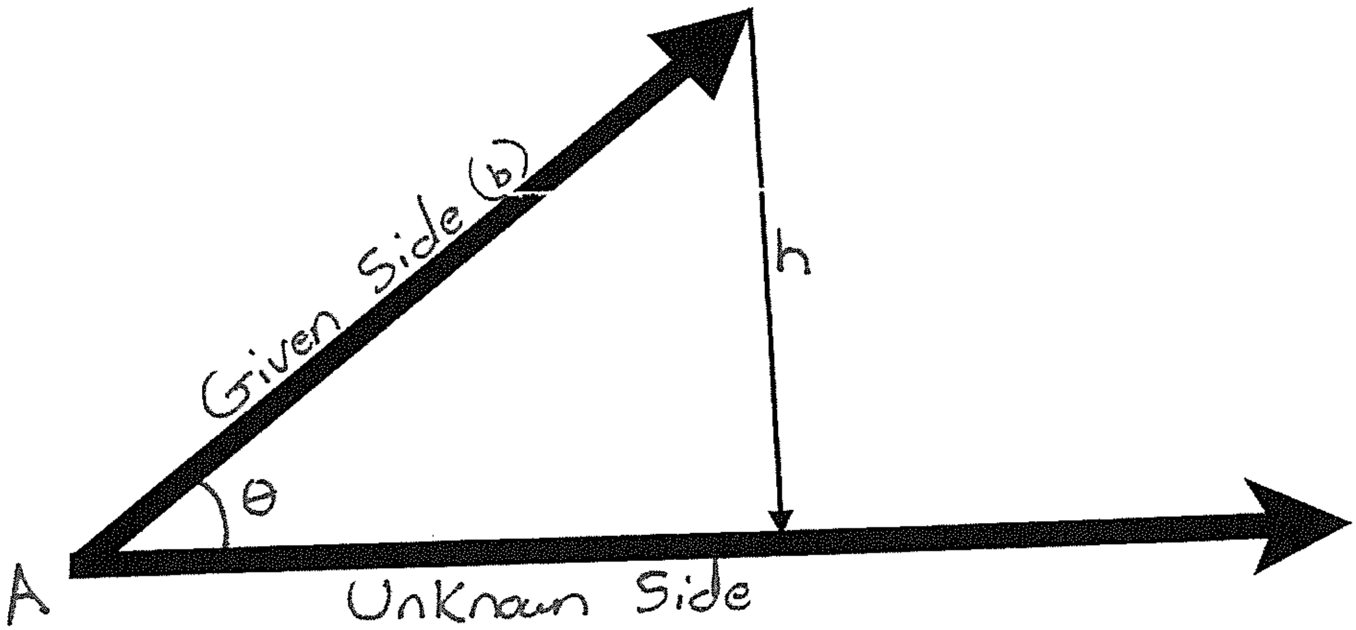
Geometric Look At The Law of Sines



Ambiguous Case For The Law of Sines

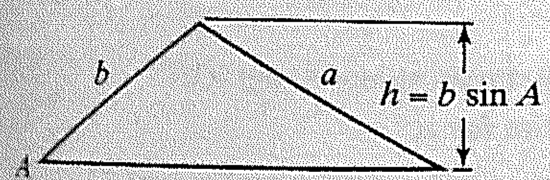


Scenario	# of Triangles	Why?
a < h		
a = h		
a > h and a > b		
a > h a < b		

The Ambiguous Case (SSA)

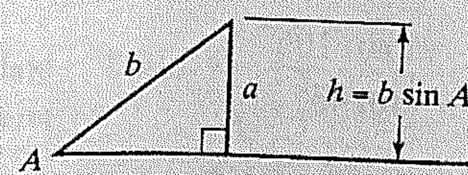
Consider a triangle in which a, b, and A are given. This information may result in

One Triangle



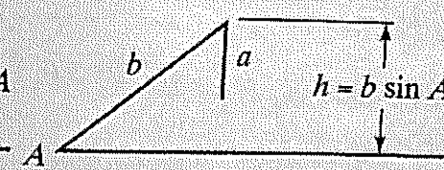
a is greater than h and a is greater than b. One triangle is formed.

One Right Triangle



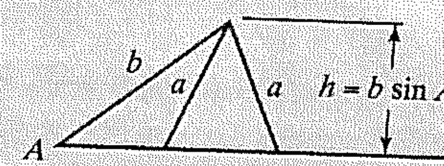
$a = h$ and is just the right length to form a right triangle.

No Triangle



a is less than h and is not long enough to form a triangle.

Two Triangles



a is greater than h and a is less than b. Two distinct triangles are formed.

The Law of Sines

If A, B, and C are the measures of the angles of a triangle, and a, b, and c are the lengths of the sides opposite these angles, then

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

The ratio of the length of the side of any triangle to the sine of the angle opposite that side is the same for all three sides of the triangle.

Check Point 5 Solve triangle ABC if $A = 35°$, $a = 12$, and $b = 16$. Round as in Example 5.

5°, $c_2 \approx 5.4$

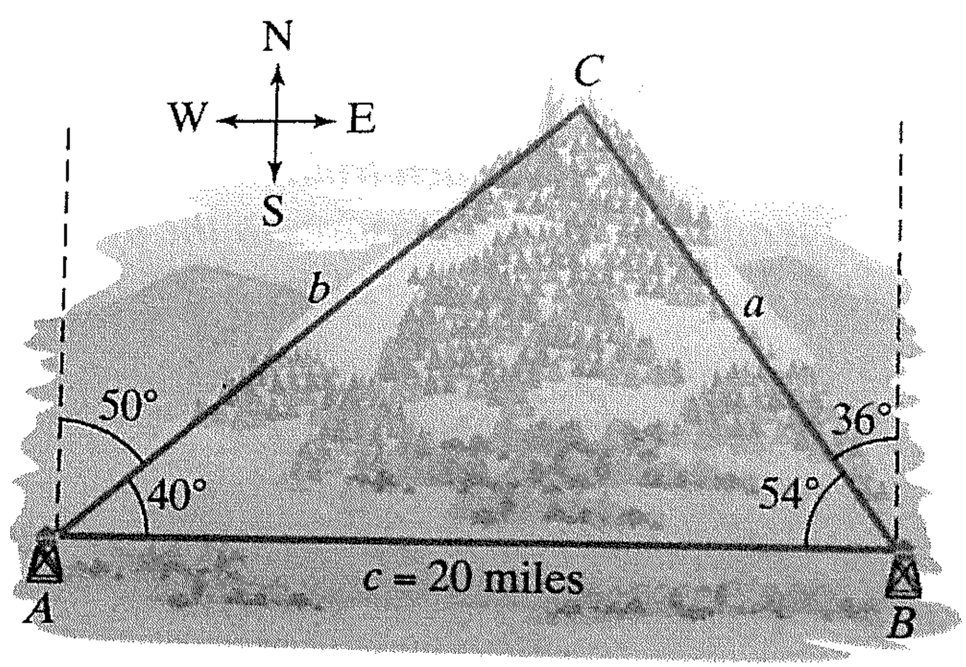
Area of an Oblique Triangle

The area of a triangle equals one-half the product of the lengths of two sides times the sine of their included angle. In **Figure 6.10**, this wording can be expressed by the formulas

$$\text{Area} = \tfrac{1}{2}bc \sin A = \tfrac{1}{2}ab \sin C = \tfrac{1}{2}ac \sin B.$$

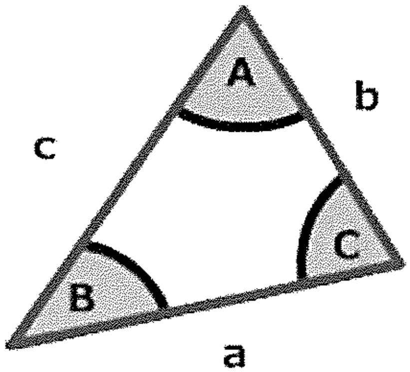
EXAMPLE 7 An Application of the Law of Sines

Two fire-lookout stations are 20 miles apart, with station B directly east of station A. Both stations spot a fire on a mountain to the north. The bearing from station A to the fire is N50°E (50° east of north). The bearing from station B to the fire is N36°W (36° west of north). How far, to the nearest tenth of a mile, is the fire from station A?



Law of Sines and Law of Cosines

Law of Cosines



$$a^2 = b^2 + c^2 - 2bc \cdot \cos(A)$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos(B)$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos(c)$$

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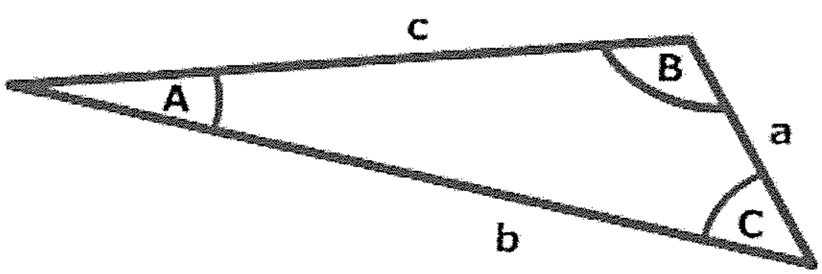
Law of Sines

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$



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$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$$

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