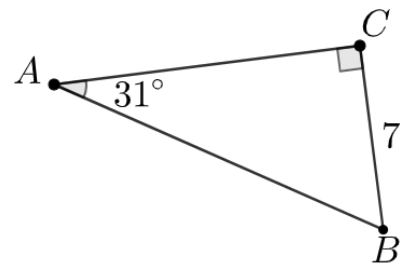
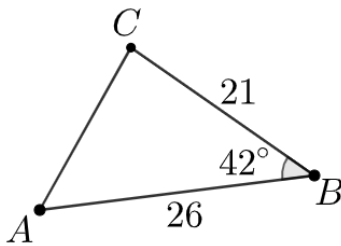
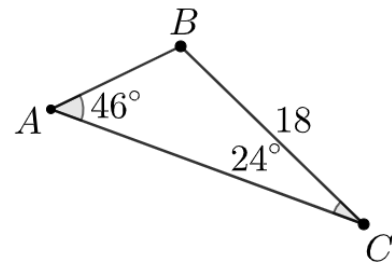
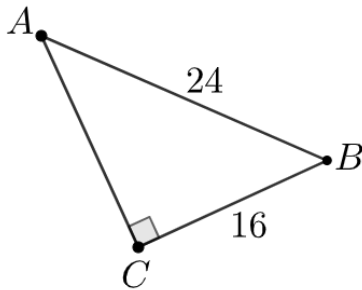


Lesson 4.09
Law of Cosines

Geometry GT

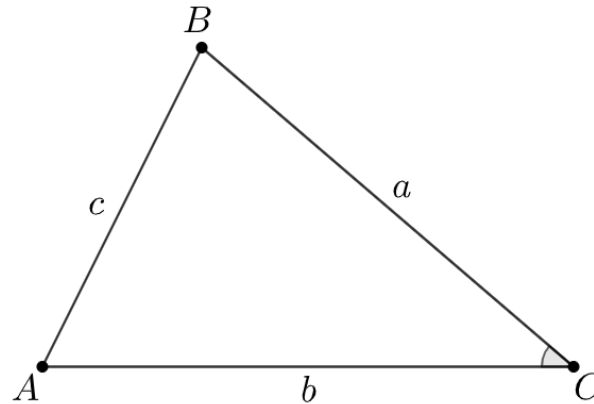
Recall

For each triangle, do you have enough information to find the length of \overline{AC} ? If so, what could you use?



Explore

The **Law of Cosines** is another tool that can be used to find missing sides and angles in oblique triangles. Consider the following triangle:



If the lengths a and b are known, in addition to the measure of $\angle C$, the Law of Sines can not be used, as there is no pair of opposite sides and angles that are known. With the Law of Cosines, however, the length of c could be found:

$$c^2 = a^2 + b^2 - 2ab \cos C$$

The proof of this theorem is outside the scope of this course. Note: the Law of Cosines can be thought of as a generalized Pythagorean Theorem, one that can be used in non-right triangles.

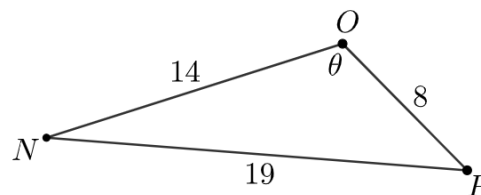
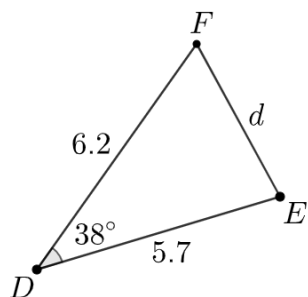
Below is a summation of solving oblique triangles:

If you know...	...you can find...	...by using...
AAS/ASA	either missing side	Law of Sines
SSA	the unknown angle opposite one of the known sides*	Law of Sines
SAS	the missing side	Law of Cosines
SSS	any missing angle	Law of Cosines

Recall: using the Law of Sines to find an angle may not always yield a single solution, if one at all, and should only be used as a last resort.

Discuss

Find the variables (d and θ) in the following problems.



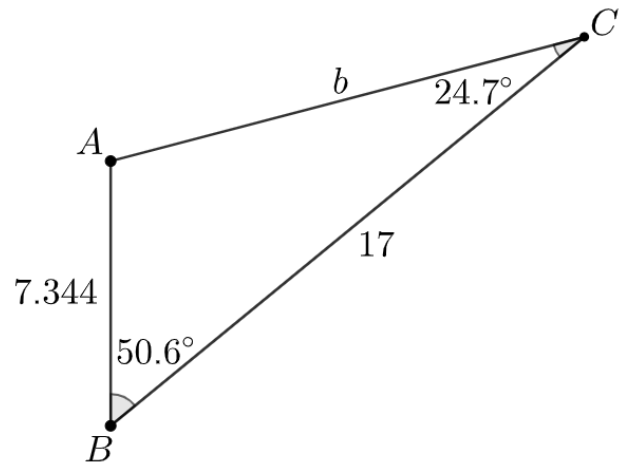
Demonstrate

Solve the Law of Cosines for the angle in the equation (that is, get C by itself in $c^2 = a^2 + b^2 - 2ab \cos C$).

Practice

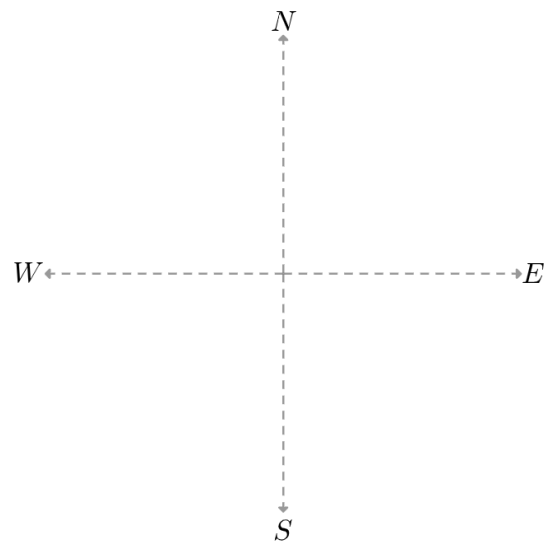
1. In $\triangle ABC$, $AB = 7.344$, $BC = 17$, $m\angle B = 50.6^\circ$, and $m\angle C = 24.7^\circ$.

A. Use the Law of Sines to find b .

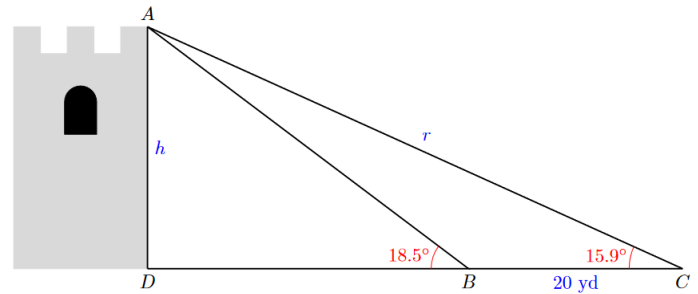


B. Use the Law of Cosines to find b .

2. Two boats leave port at the same time. One boat sails due west at a speed of 17 miles per hour, the other powers 42° east of north at a speed of 23 miles per hour. How far apart are the two boats after 2 hours?



3. Patrick wants to measure the height of a castle controlled by hostile forces. When he is as close as he can get to the castle, the angle of elevation to the top of the wall is 18.5° . He then retreats 20 yards and measures the angle of elevation again; this time it is 15.9° . How tall is the castle?



4. The sides of a triangle are 54mm, 30mm, and 40mm. Find the area of the triangle.