

# Laws of Sine and Cosine

## Law of Sines

Involves angle/opposite edge pairs.

Formula

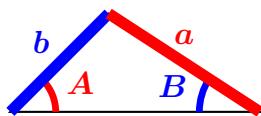
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Note:  $A + B + C = 180^\circ$

Application

$$b = a \cdot \frac{\sin B}{\sin A}$$

$$B = \arcsin\left(\sin A \cdot \frac{b}{a}\right)$$



## Law of Cosines

Involves all edges and one angle.

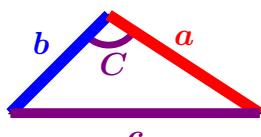
Formula

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

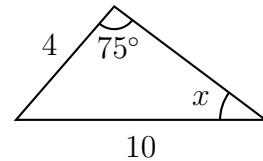
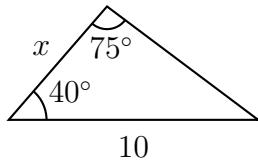
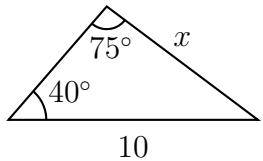
Application

$$c = \sqrt{a^2 + b^2 - 2(a)(b)\cos C}$$

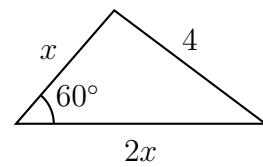
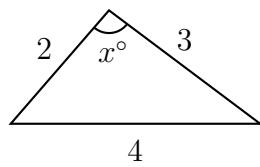
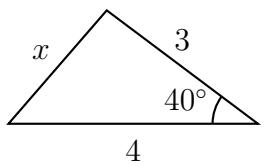
$$C = \arccos\left(\frac{a^2 + b^2 - c^2}{2(a)(b)}\right)$$



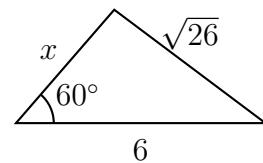
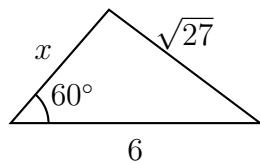
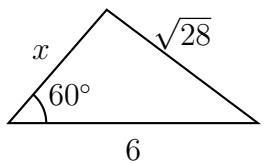
1. In each of the triangles below, use the Law of Sines to find the indicated value  $x$ . Leave your answers as unreduced expressions. (Triangles are not drawn to scale.)



2. In each of the triangles below, use the Law of Cosines to find the indicated value  $x$ .  
Leave your answers as unreduced expressions. (Triangles are not drawn to scale.)



3. For the triangles below, solving for  $x$  using the Law of Cosines requires solving a quadratic.  
There may be one, two, or no solutions.  
(Triangles are not drawn to scale.)



Challenge. Is it possible for a triangle to have  $a = 2b$  and  $A = 2B$ ?