Objective: In this lesson, you will prove the Laws of Sines and Cosines and use them to solve problems.

Law of Sines

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

Use the law of sines if you are given 2 sides and one angle opposite one of the given sides. Or if you are given 2 angles and a side opposite one of the given angles.

Example

If the length of side \(a\) is 12 centimeters, \(m \angle B = 36^\circ\), and \(m \angle C = 75^\circ\), what is the length of side \(b\)?

Round your response to two decimal places.
Example

If the length of side $a$ is 16 centimeters, the length of side $b$ is 10 centimeters, and $\angle A = 42^\circ$, what is the measure of $\angle B$? Round your answer to two decimal places.

Law of Cosines

Use the law of cosine if you are given three sides $\Delta ABC$, or two sides and the included angle, as in $\Delta PQR$

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cos C$$

These equations can be used

- to find an unknown side length if ________________
- to find any of the angles if all ________________
Example

If the length of side $a$ is 6 centimeters, the length of side $b$ is 4 centimeters, and the length of side $c$ is 7 centimeters, what is the measure of $\angle B$? Round your answer to two decimal places.

Example

If the length of $a$ is 16 centimeters, the length of $b$ is 10 centimeters, and the measure of $\angle C$ is 22°, what is the length of $c$? Round your answer to two decimal places.