Trigonometry Summary
Everything You Need

When solving for sides or angles of a triangle, first decide whether you can use the easy steps.

1. Can you use “the sum of the angles in a triangle is 180°”
   Can you use properties of isosceles triangles?

If it’s a right triangle…

2. Can you use the Pythagorean theorem?
   Can you use SOH-CAH-TOA?

Example:

Calculating the missing angle \( \angle FED = 180 - (25 + 90) = 65° \) doesn’t require trig, but it is not necessary for finding \( \angle FE \).

SOH-CAH-TOA…

SOH-CAH-TOA can also be used to find the missing angle in a right triangle.

Example:
If it is not a right triangle, and you have the situation AAS, ASA or ASS…

3. Use the **Law of Sines**

Note: There must be a known side length opposite to a known angle measure.

![Diagram of triangle KMN with angles and sides labeled]

**Example:**

To find \( k \), use the measure of \( \angle K \)

\[
\frac{29}{\sin(66)} = \frac{k}{\sin(39)}
\]

\( k \sin(66) = 29 \sin(39) \)

\( k = \frac{29 \sin(39)}{\sin(66)} \)

\( k \approx 20.0 \text{ cm} \)

To find \( n \), first you need to find \( \angle N = 75^\circ \)

\[
\frac{29}{\sin(66)} = \frac{n}{\sin(75)}
\]

\( n \sin(66) = 29 \sin(75) \)

\( n = \frac{29 \sin(75)}{\sin(66)} \)

\( n \approx 30.7 \text{ cm} \)

The Sine Law can be used to find the missing angle too (in the case of ASS).

**Example:** Find the measure of angle \( V \)

![Diagram of triangle TSV with angles and sides labeled]

\[
\frac{47}{\sin(42)} = \frac{70}{\sin(V)}
\]

\( 47 \sin(V) = 70 \sin(42) \)

\( \sin(V) = \frac{70 \sin(42)}{47} \)

\( V = \sin^{-1}\left(\frac{70 \sin(42)}{47}\right) \)

\( m\angle V = 85^\circ \)

**The Ambiguous Case**

Be careful… inverse sine will only return an acute angle (even if you know it’s supposed to be obtuse). If the angle is supposed to be obtuse, subtract from \( 180^\circ \).
If it is not a right triangle, and you have the situation SAS, or SSS…

4. Use the Law of Cosines

Example:

To set up the formula, set it up like the Pythagorean theorem with \( g \) as the “pretend” hypotenuse and \( \angle G \) as the “pretend” right angle.

You can find a missing angle using the cosine law (you need to know all three sides).

Example:

When you have a choice of which angle to find first, always find the measure of the largest angle (opposite the longest side).

\[
25^2 = 9^2 + 19^2 - 2(9)(19)\cos(Q)
\]

\[
2(9)(19)\cos(Q) = 9^2 + 19^2 - 25^2
\]

\[
342\cos(Q) = -183
\]

\[
\cos(Q) = \frac{-183}{342}
\]

\[
Q = \cos^{-1}\left(\frac{-183}{342}\right)
\]

\[
Q = 122^\circ
\]