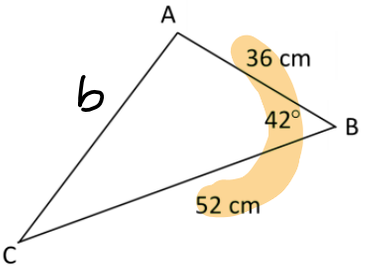
1.6 The Cosine Law

Learning Goals: I am learning to…
- ☐ Explain and identify when to use the Cosine Law
- ☐ Solve for an unknown side and/or angle using the Cosine Law

Warm-up: Given the triangle below, you are asked to find side b.



1) Why can't you use the Pythagorean theorem?

not a right triangle

2) Why can't you use SOH CAH TOA?

not a right triangle

3) Why can't you use the Sine Law?

we don't know a complete pair (side and it's opposite angle)

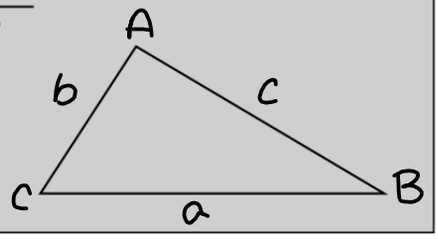
Cosine Law:

Side

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

angle

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



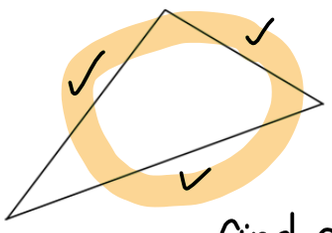
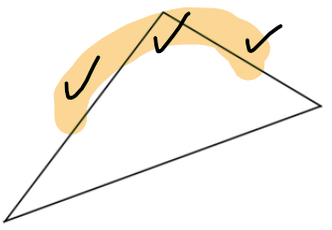
To use cosine law you need to know either:
1) All three side lengths (SSS)
2) Two sides and the contained angle (SAS)

Try rewriting the Cosine Law for all other possible unknown sides and angles. Are there any patterns you notice?

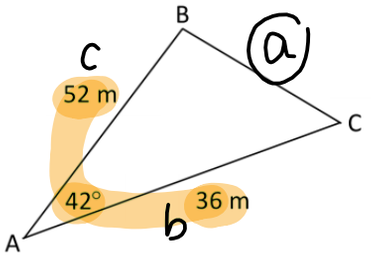
Unknown Side	Unknown Angle
$c^2 = a^2 + b^2 - 2ab(\cos C)$	$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$
Side a? $a^2 = b^2 + c^2 - 2bc(\cos A)$	Angle A? $\cos A = \frac{b^2+c^2-a^2}{2bc}$
Side b? $b^2 = a^2 + c^2 - 2ac(\cos B)$	Angle B? $\cos B = \frac{a^2+c^2-b^2}{2ac}$

MAP4C1 Unit 1: Trigonometry

As with the Sine Law, there are conditions on when to use the Cosine Law.

Finding an Unknown Angle	Finding an Unknown Side
 know all sides → find any angle	 know 2 sides and contained angle.

Example 1: Use the Cosine Law to find the unknown side length, a.



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

$a^2 = 36^2 + 52^2 - 2(36)(52)(\cos 42°)$

$a^2 = 1296 + 2704 - (3744 \cos 42°)$

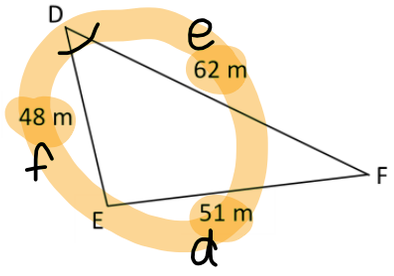
$a^2 = 1217.666$

$a = 34.9\text{m}$

*BEDMAS!

*square root!

Example 2: Use the Cosine Law to find the unknown angle, D.



$\cos D = \frac{e^2 + f^2 - d^2}{2ef}$

$\cos D = \frac{62^2 + 48^2 - 51^2}{2(62)(48)}$

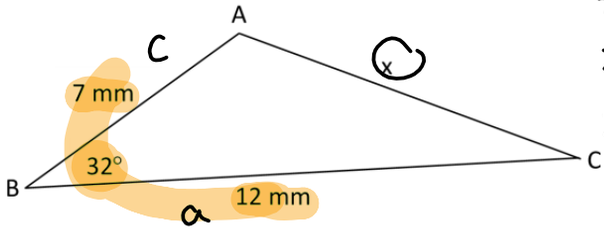
$\cos D = \frac{3844 + 2304 - 2601}{5952}$

$\cos D = \frac{3547}{5952}$

$D = \cos^{-1}\left(\frac{3547}{5952}\right)$

$D = 53.4°$

Example 3: Determine the measure of side, x.



$x^2 = a^2 + c^2 - 2ac \cos B$

$x^2 = 12^2 + 7^2 - 2(12)(7) \cos 32°$

$x^2 = 144 + 49 - 168 \cos 32°$

$x^2 = 193 - 168 \cos 32°$

$x^2 = 50.5$

$x = 7.1\text{mm}$