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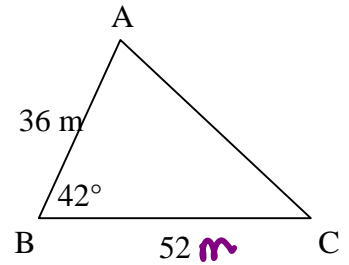
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Lesson 1.6 – The Cosine Law

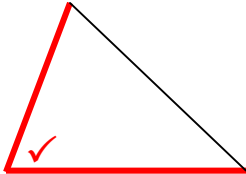
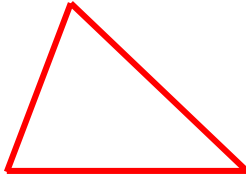
- Learning Goal: I can determine an unknown side or angle in an acute triangle using cosine law

You're asked to find side b in $\triangle ABC$ (on the diagram to the right).

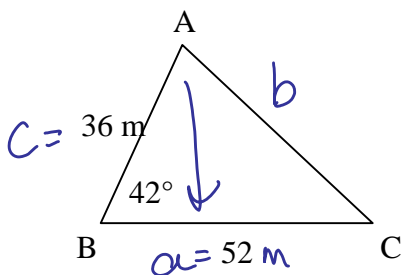
- Why can't you use the pythagorean theorem? Not a right triangle
- Why can't you use SOH CAH TOA? Not a right triangle
- Why can't you use the Sine Law? We don't know a side and the angle across from it.



We need another formula!

Cosine Law		
$a^2 = b^2 + c^2 - 2bc \cos A$	<div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">OR</div>	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
$b^2 = a^2 + c^2 - 2ac \cos B$ $c^2 = a^2 + b^2 - 2ab \cos C$		$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$ $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$
<p><u>The Cosine law can be used when given:</u></p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>a) The measure of 2 sides and the contained angle</p>  </div> <div style="width: 45%;"> <p>b) The measure of three sides</p>  </div> </div>		

Example 1: Solve for b



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

$$b^2 = (52)^2 + (36)^2 - 2(52)(36)\cos 42^\circ$$

$$b^2 = 1217.665773$$

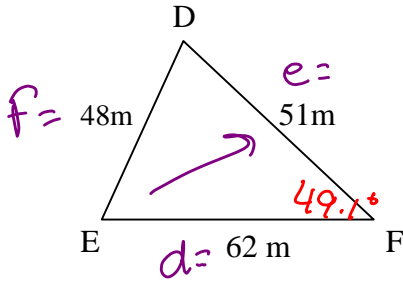
$$b = \sqrt{1217.665773}$$

$$= 34.9 \text{ m}$$

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Example 2: Solve for each angle.



$$\cos F = \frac{d^2 + e^2 - f^2}{2de}$$

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

$$\cos F = \frac{4141}{6324}$$

$$\cos F = 0.6548$$

$$F = \cos^{-1}(0.6548) = 49.1^\circ$$

$$E = 180^\circ - 49.1^\circ - 77.5^\circ$$

$$E = 53.4^\circ$$

∴ The angles measure 49.1°, 77.5° and 53.4°

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

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

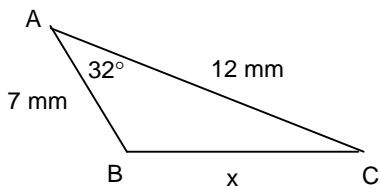
$$\cos D = \frac{51^2 + 48^2 - 62^2}{2(51)(48)}$$

$$\cos D = \frac{1061}{4896}$$

$$\cos D = 0.2167$$

$$D = \cos^{-1}(0.2167) = 77.5^\circ$$

Example 3: Solve for x.



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

$$x^2 = 49 + 144 - 168\cos 32^\circ$$

$$x^2 = 50.5279$$

$$x = \sqrt{50.5279}$$

$$x = 7.1 \text{ mm}$$