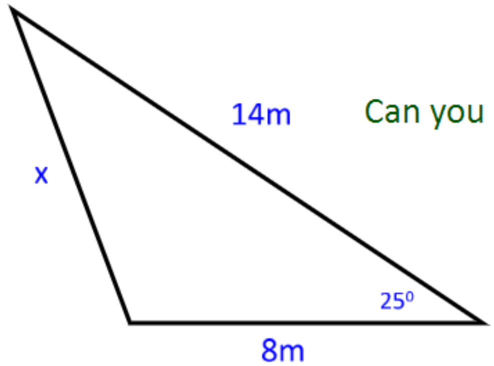
When we don't have a right angle triangle and Sine Law may not be an option



Can you solve for the unknown?

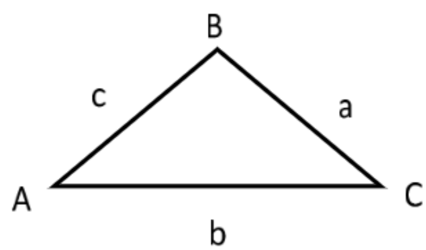
No!

We need a new formula to solve this triangle.

Cosine Law: In Δ ABC

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

use to find a side length when given 2 sides and a contained angle



Similar Equations...

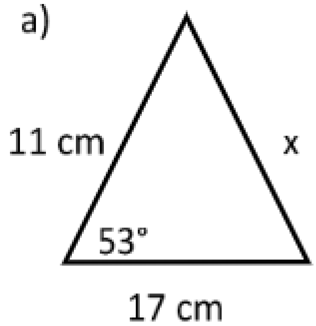
$$b^2 = a^2 + c^2 - 2ac \cos B$$

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

Can you see the pattern?

Ex. 1: Determine the unknown variable using the cosine law.

a)



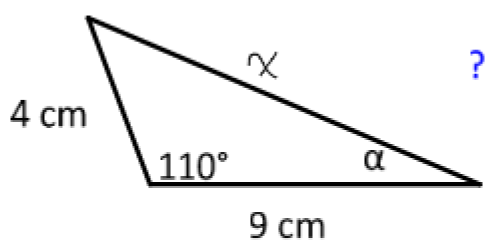
$x^2 = 11^2 + 17^2 - 2(11)(17)\cos 53°$

$x^2 \doteq 184.9$

$x = \pm\sqrt{184.9}$

$\underbrace{\because x > 0}_{\text{Must be positive}} \quad \therefore x \doteq 13.6 \text{ cm}$

b)



? hint: need to find 3rd side first!!!!

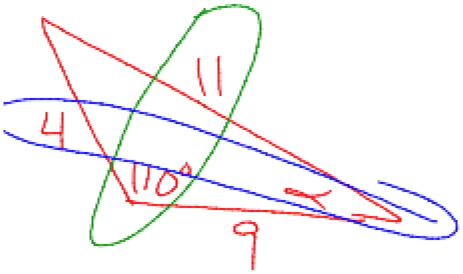
① Find x via cosine law

② Find α using sine OR cosine law

① $x^2 = 4^2 + 9^2 - 2(4)(9)\cos 110°$

$\because x > 0 \quad \therefore x \doteq 11 \text{cm}$

② Sine law for α



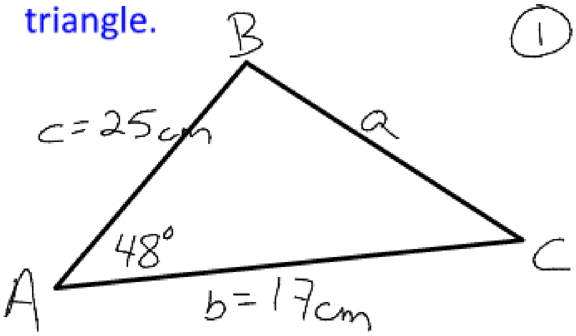
$$\frac{\sin\alpha}{4} = \frac{\sin 110°}{11}$$

$$\sin\alpha = 4 \cdot \frac{\sin 110°}{11}$$

$$\sin\alpha \doteq 0.3417$$

$$\alpha \doteq 20°$$

Ex. 3 Given ΔABC, where A= 48°, b= 17 cm and c= 25 cm, solve the triangle.



① $a^2 = 25^2 + 17^2 - 2(25)(17)\cos 48°$

$a \doteq 18.58\text{cm}$

② $\frac{\sin C}{25} = \frac{\sin 48°}{18.58}$

$C = \sin^{-1}\left(25 \cdot \frac{\sin 48°}{18.58}\right)$

$\doteq 89.3°$

③ $B = 180 - 48° - 89.3°$

$= 42.7°$

$\angle B = 42.7°$

$\angle C = 89.3°$

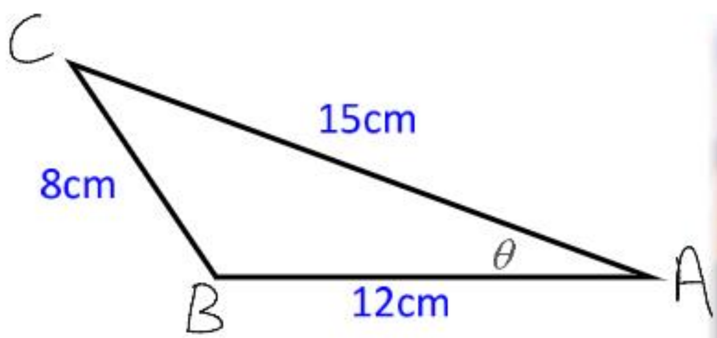
$a \doteq 18.6\text{cm}$

Sine Law vs. Cosine Law

Sine Law: Use when you have an angle- side pair

Cosine Law: Use when you have 2 sides and a CONTAINED angle or 3 sides

6.7 Find Angles Using the Cosine Law



Can you find the unknown angle using Cosine Law???

Try it!

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

$$8^2 = 15^2 + 12^2 - 2(15)(12)\cos\theta$$

$$64 = 225 + 144 - 360 \cdot \cos\theta$$

$$64 - 369 = -360\cos\theta$$

$$\frac{-305}{-360} = \cos\theta$$

$$0.8472 = \cos\theta$$

$$\theta = \cos^{-1}(0.8472)$$

$$\theta = 32^\circ$$