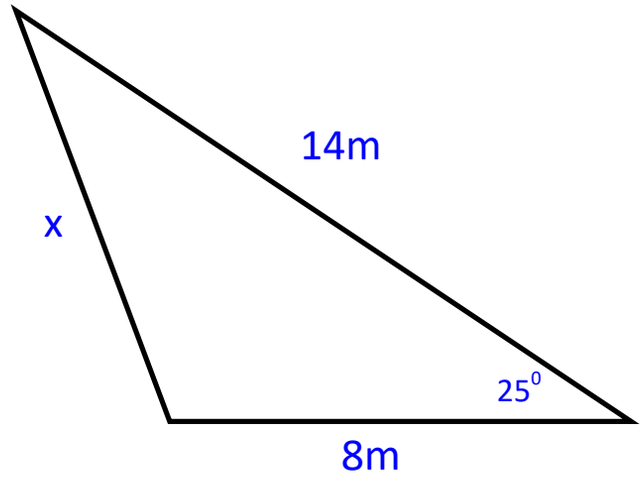
How can we solve this?



We need something new!

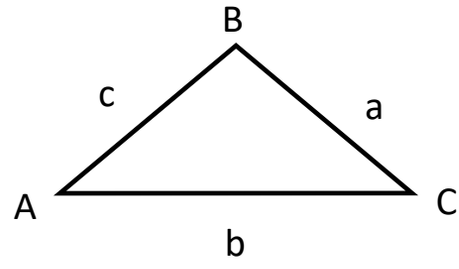
1.7 The Cosine Law

We need a new formula!

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



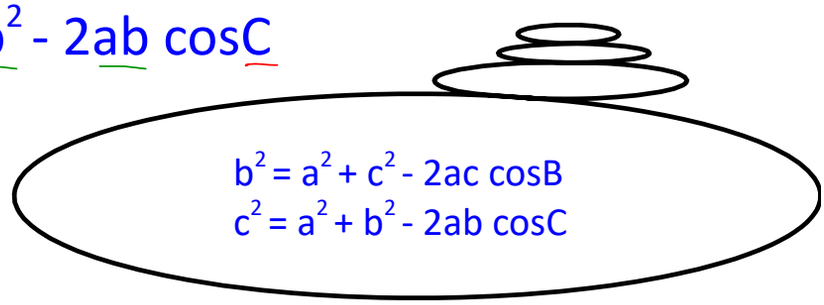
Write the Cosine Law in terms of side b.

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

Write the Cosine Law in terms of side c.

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

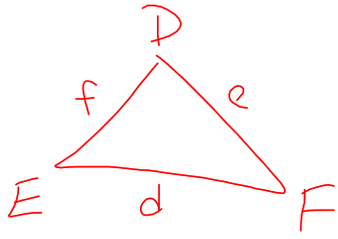
Can you see the pattern?



It looks like Pythagorean Formula

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

^ with a bit extra

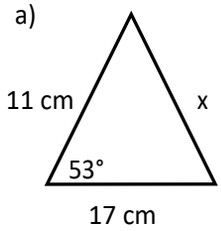


$d^2 = e^2 + f^2 - 2ef\ \cos D$

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

1) Determine the unknown variable using the cosine law.

a)



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

$x^2 = 410 - 374\cos 53°$

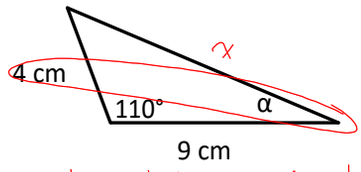
$x^2 = 184.9$

$x = \sqrt{184.9}$

$= 13.6$

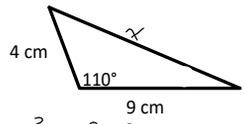
Do all in one step

b)



I want to use sine law!

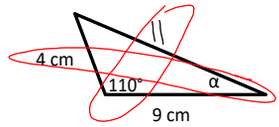
- Use cosine law to find x



$x^2 = 4^2 + 9^2 - 2(4)(9)\cos 110°$

$x^2 = 121.6$

$x = 11.0$



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

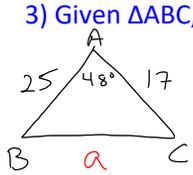
$\sin\alpha = 4\left(\frac{\sin 110}{11}\right)$

$\sin\alpha = 0.3417$

$\alpha = \sin^{-1}(0.3417)$

$\doteq 20°$

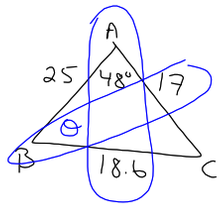
3) Given ΔABC, where A= 48°, b= 17 cm and c= 25 cm, solve the triangle.



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

$a^2 = 345.2$

$a \doteq 18.6$



$\frac{\sin\theta}{17} = \frac{\sin 48}{18.6}$

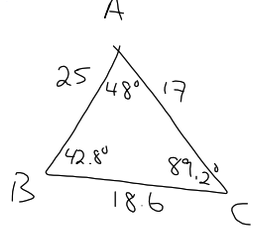
$\sin\theta = 17 \cdot \frac{\sin 48}{18.6}$

$\theta = \sin^{-1}\left(17 \cdot \frac{\sin 48}{18.6}\right)$

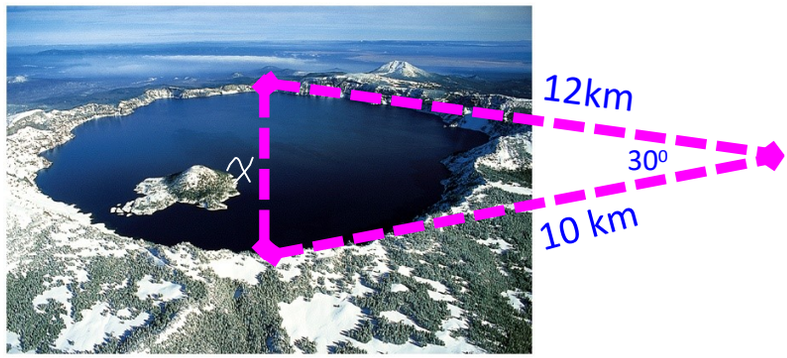
$= 42.8°$

$C = 180° - 48° - 42.8°$

$= 89.2$



2) Find the width of the lake, to the nearest metre, given the following:



$x^2 = 12^2 + 10^2 - 2(12)(10)\cos 30^\circ$

$= 36.2$

$x = 6$

∴ The width of the lake is approx. 6 km

Practice

Set 1: p. 409 #C1,C2,1a,3a,4b,7,9

Set 2: p. 409 #C1,C2,3,4b,8,11,15