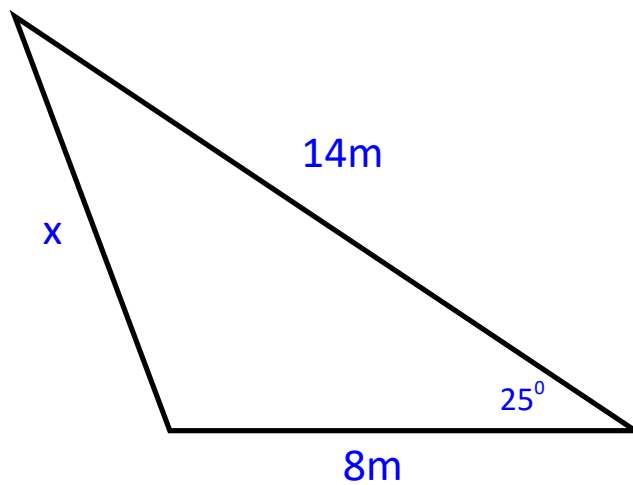


How can we solve this?



We need something new!



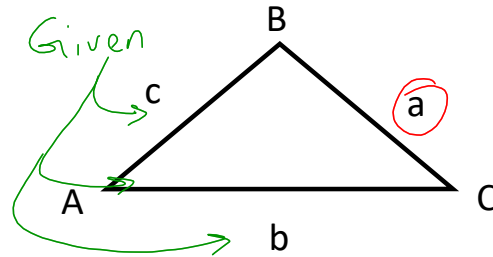
1.7 The Cosine Law

We need a new formula!

Cosine Law: In $\triangle ABC$

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

****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.

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

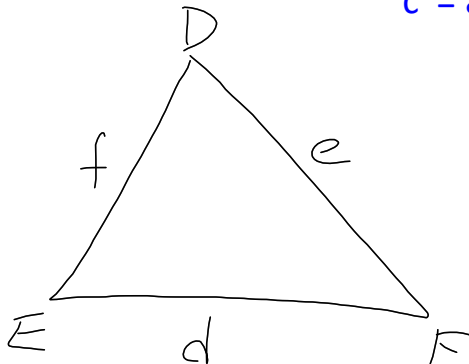
Can you see
the pattern?

$$\begin{aligned} b^2 &= a^2 + c^2 - 2ac \cos B \\ c^2 &= a^2 + b^2 - 2ab \cos C \end{aligned}$$

It looks like Pythagorean Formula

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

^ with a bit extra

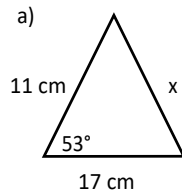


$$d^2 = e^2 + f^2 - 2ef \cos D$$

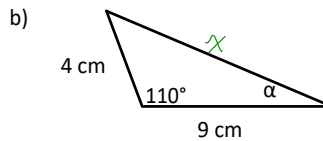
$$e^2 = d^2 + f^2 - 2df \cos E$$

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

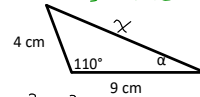
1) Determine the unknown variable using the cosine law.



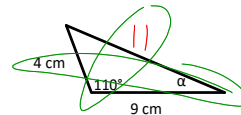
$$\begin{aligned} x^2 &= 11^2 + 17^2 - 2(11)(17)\cos 53^\circ \\ &= 410 - 225.07 \\ &= 184.93 \\ x &= \sqrt{184.93} \\ &= 14 \end{aligned}$$



- Want to use Sine law!
Need x .
- Use cosine law to solve for x



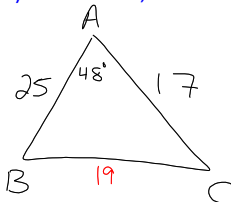
$$\begin{aligned} x^2 &= 4^2 + 9^2 - 2(4)(9)\cos 110^\circ \\ &= 121.6 \\ x &= 11 \end{aligned}$$



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

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

$$\begin{aligned} \alpha &= \sin^{-1}\left(\frac{4 \cdot \sin 110}{11}\right) \\ &= 20^\circ \end{aligned}$$

3) Given $\triangle ABC$, where $A = 48^\circ$, $b = 17$ cm and $c = 25$ cm, solve the triangle.

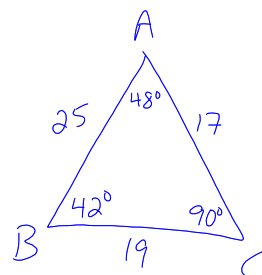
Plan?

- ① - cosine law for a
- ② - Sine law for b or c
- ③ - sum of angles for last angle

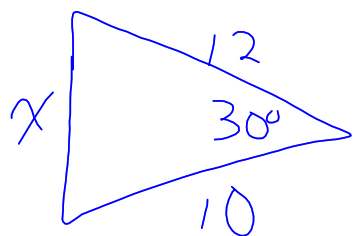
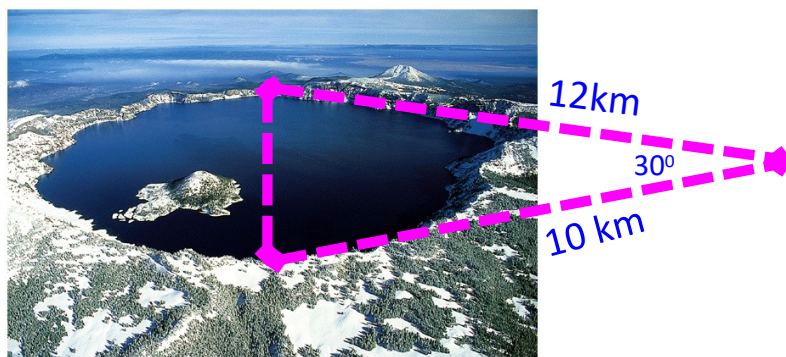
$$\begin{aligned} \textcircled{1} \quad a^2 &= 25^2 + 17^2 - 2(25)(17)\cos 48^\circ \\ &= 345.2 \\ a &= 19 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad \frac{\sin B}{17} &= \frac{\sin 48}{19} \\ \sin B &= \frac{17 \cdot \sin 48}{19} \\ B &= \sin^{-1}\left(\frac{17 \cdot \sin 48}{19}\right) \\ &= 42^\circ \end{aligned}$$

$$\begin{aligned} \textcircled{3} \quad C &= 180 - 42 - 48 \\ &= 90 \end{aligned}$$



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



$$\begin{aligned}x^2 &= 10^2 + 12^2 - 2(10)(12)\cos 30^\circ \\&\approx 36.2 \\x &\approx 6\end{aligned}$$

$\therefore$ The width of the lake is 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

