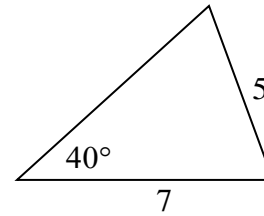
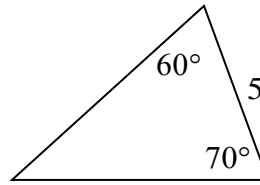
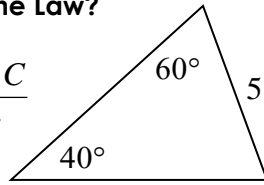


**APPLICATIONS OF TRIGONOMETRY**

• When can we use Sine Law?

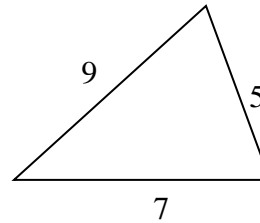
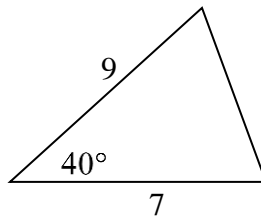
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$



The Sine Law can be used when we have a side length opposite a known angle and another side length or angle

• When can we use Cosine Law?

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



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

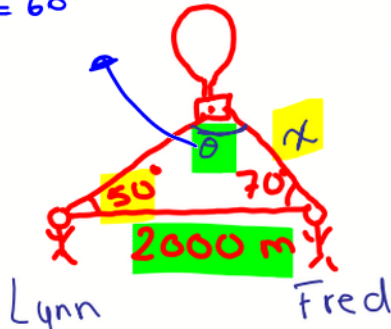
The Cosine Law can be used when we have a contained angle or all three-side lengths

Keys to solving word problems

- 1) Read the problem carefully
- 2) **Sketch a diagram** and record your known measurements in the appropriate places.
- 3) Identify unknown.
- 4) Use triangle relationships to determine the unknown measures.

**Example 1:** Lynn and Fred, standing 2 000 metres apart, spotted a hot air balloon at angles of elevation of 50° and 70° respectively. The hot air balloon is located between them. What is the distance from Fred directly to the hot air balloon? Show your work.

$$\begin{aligned} \angle &= 180 - 50 - 70 \\ &= 60 \end{aligned}$$



$$\frac{x}{\sin 50} = \frac{2000}{\sin 60}$$

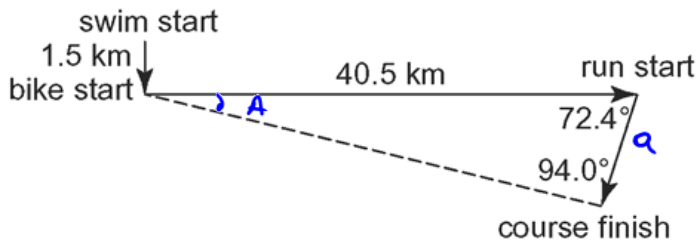
multiply both sides by  $\sin 50$   
to cancel  $\sin 50$  on left side

$$x = \frac{2000}{\sin 60} \cdot \sin 50$$

$$x \approx 1769.$$

$\therefore$  Fred is 1769m away from the balloon.

**Example 2:** A triathlon is an event that has competitors swim, run, and bicycle over a set course. The organizers of a triathlon wish to know the total length of the course and took the measurements shown. Determine the total length of the course, represented in the diagram by the arrows.



Step 1: side a

$$\angle A = 180 - 72.4 - 94$$

$$\angle A = 13.6$$

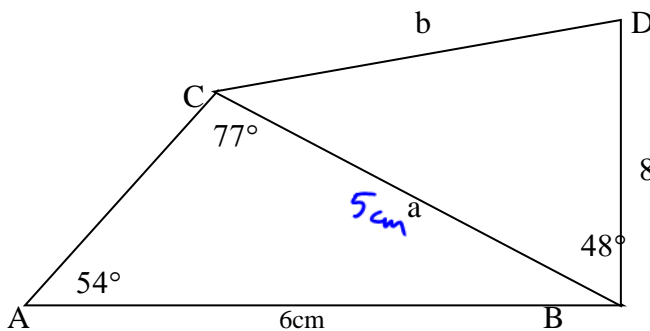
$$\frac{a}{\sin 13.6} = \frac{40.5}{\sin 94}$$

$$a = \frac{40.5}{\sin 94} \cdot \sin 13.6$$

$$a = 9.5 \text{ km}$$

∴ The length of the course is  $1.5 + 40.5 + 9.5 = 51.5 \text{ km}$

**Example 3:** Determine lengths a and b



Step 1: side a using the sine law

$$\sin 54 \cdot \frac{a}{\sin 54} = \frac{6}{\sin 77} \cdot \sin 54$$

$$a = \frac{6}{\sin 77} \cdot \sin 54$$

$$a \approx 4.98 \text{ cm}$$

Step 2: side b using the cosine law

$$b^2 = 5^2 + 8^2 - 2 \cdot 5 \cdot 8 \cdot \cos 48$$

$$b^2 = 35.4696$$

$$\sqrt{b^2} = \sqrt{35.4696}$$

$$b = 5.95 \text{ cm}$$