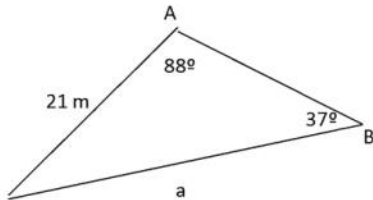


The Cosine Law

Warm-up

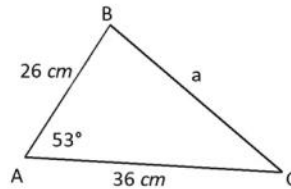
Solve for the indicated side in each triangle below.



$$\frac{\sin 37}{21} = \frac{\sin 88}{a}$$

$$a = \frac{21 \sin 88}{\sin 37}$$

$$= 34.9$$

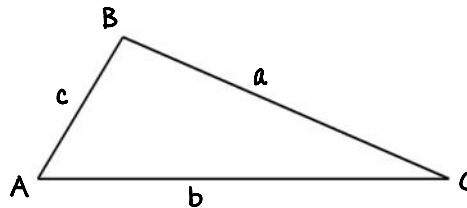


We don't have enough information to use the Sine Law.

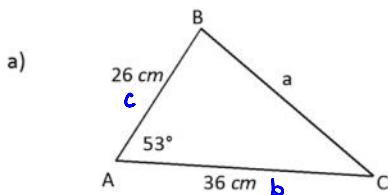
(Need an angle and its opposite side length.)

We will now introduce the cosine law.

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



Use the Cosine Law to solve for the indicated sides in the triangles below.

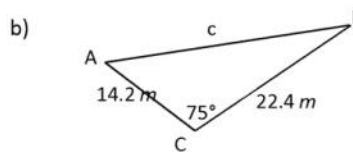


$$a^2 = 36^2 + 26^2 - 2(36)(26)(\cos 53)$$

$$\doteq 845.4$$

$$a = \sqrt{845.4}$$

$$\doteq 29.1 \text{ cm}$$



$$c^2 = 14.2^2 + 22.4^2 - 2(14.2)(22.4)(\cos 75)$$

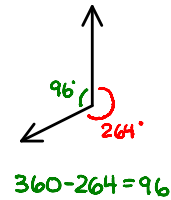
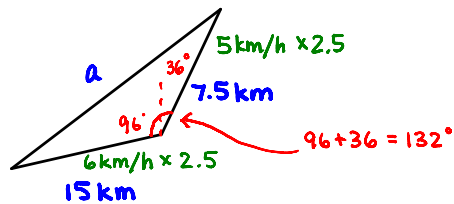
$$\doteq 538.7$$

$$c = \sqrt{538.7}$$

$$\doteq 23.2 \text{ m}$$

Suppose two hikers leave from the same spot at the same time. The first hiker heads on a bearing of 36° , at a speed of 5 km/h. The second hiker leaves on a bearing of 264° at a speed of 6 km/h.

Find the distance between the two hikers after 2.5 hours.



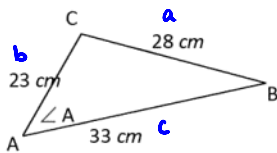
$$a^2 = 15^2 + 7.5^2 - 2(15)(7.5)(\cos 132)$$

$$\doteq 431.8$$

$$a \doteq 20.8$$

The hikers are 20.8 km apart.

We can also use the cosine law to solve for an angle when we have all 3 sides.



$$28^2 = 23^2 + 33^2 - 2(23)(33)(\cos A)$$

$$28^2 - 23^2 - 33^2 = -2(23)(33)(\cos A)$$

$$\frac{-834}{-1518} = \frac{-1518 \cos A}{-1518}$$

$$0.5494 \doteq \cos A$$

$$\cos^{-1}(0.5494) = A$$

$$56.7^\circ = A$$