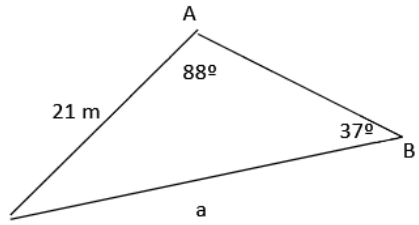
MPM2D Unit 6, Lesson 8

The Cosine Law

Warm-up

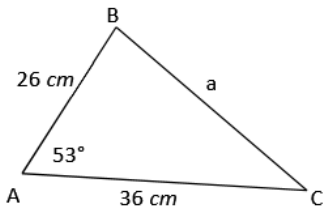
Solve for the indicated side in each triangle below.



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

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

$$a \doteq 35 m$$



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

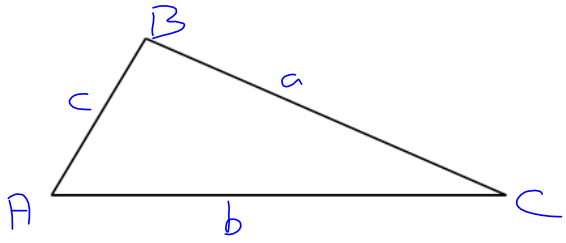
$$a \doteq 29 cm$$

We will now introduce the cosine law.

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

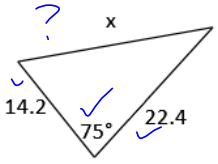
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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



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

SAS



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

$$x \doteq 23$$

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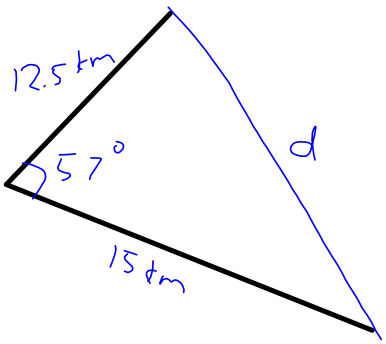
Suppose two hikers leave from the same spot at the same time. The first hiker heads on a bearing of 46°, at a speed of 5 km/h. The second hiker leaves on a bearing of 103° at a speed of 6 km/h.

$5\text{ km/h} \times 2.5\text{ h} = 12.5\text{ km}$

$6\text{ km/h} \times 2.5\text{ h} = 15\text{ km}$

Find the distance between the two hikers after 2.5 hours.



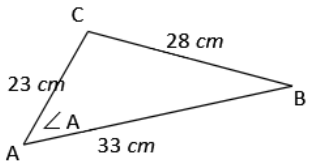
$103° - 46°$

$= 57°$

$d^2 = 15^2 + 12.5^2 - 2(15)(12.5)\cos 57°$

$d \doteq 13.3\text{ km}$

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



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

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

$784 = 1618 - 1518\cos A$

$-834 = -1518\cos A$

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

$A = \cos^{-1}\left(\frac{834}{1518}\right)$

$A \doteq 57°$

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

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

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

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

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ $\quad \cos B = \frac{a^2 + c^2 - b^2}{2ac}$ $\quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$

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