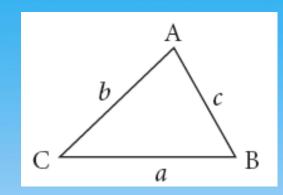


## ST. Jean de Breseuf Markemarks

### CHAPTER 14THE COSINE LAW

### **KEY CONCEPTS**

For any triangle, △ABC, the **Cosine Law** can be used to solve **side lengths** and **angles** 



To find the measure of any side, given two sides and the contained angle, the Cosine Law can be written as follows (sideangle-side or SAS)

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

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

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

The Cosine Law can also be used to find the measure of an unknown angle, given three sides (side-side-side or SSS)

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

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

$$\cos C = \frac{a^2 + b^2 - c^2}{CABILADabTH ONLINE.COM}$$

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

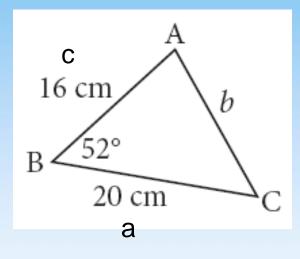
$$b^{2} = a^{2} + c^{2} - 2ac \cos B$$

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

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

Finding The Measure of a Side, Given Two Sides and a Contained Angle

Find the measure of the unknown side. Express your answer to one decimal place.



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

$$b^{2} = (20)^{2} + (16)^{2} - 2(20)(16)(\cos 52^{\circ})$$

$$b^{2} = 261.9767$$

$$\sqrt{b^{2}} = \sqrt{261.9767}$$

$$b = 16.2 \, cm$$



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

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

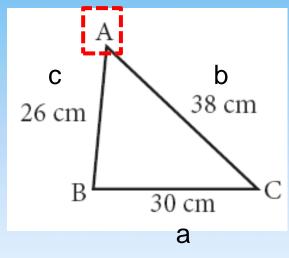
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$$c^{2} = a^{2} + b^{2} - 2ab\cos C$$
$$\cos C = \frac{a^{2} + b^{2} - c^{2}}{2ab}$$

Find the Measure of an Angle, Three Side Lengths Given

Find the measure of  $\angle A$  to the <u>nearest degree</u>.



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

$$\cos A = \frac{(38)^2 + (26)^2 - (30)^2}{2(38)(26)}$$

$$\cos A = \frac{1444 + 676 - 900}{1976}$$

$$\cos A = \frac{1220}{1976}$$

$$\cos A = 0.6174$$

$$\angle A = \cos^{-1}(0.6174)$$

$$\angle A = 52^{\circ}$$



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

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

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

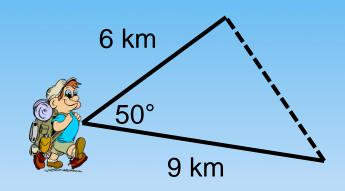
$$c^{2} = a^{2} + b^{2} - 2ab\cos C$$

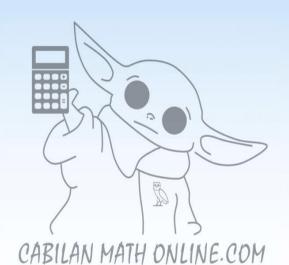
$$\cos C = \frac{a^{2} + b^{2} - c^{2}}{2ab}$$

Solving Problems Using the Cosine Law

Two hikers set out in different directions from a marked tree on the Bruce Trail. The angle formed between their paths measures **50°**. After 2 h, one hiker is **6 km** from the starting point and the other is **9 km** from the starting point. How far apart are the hikers? Express your answer to one decimal place.

Draw a diagram and solve for the unknown distance





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

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

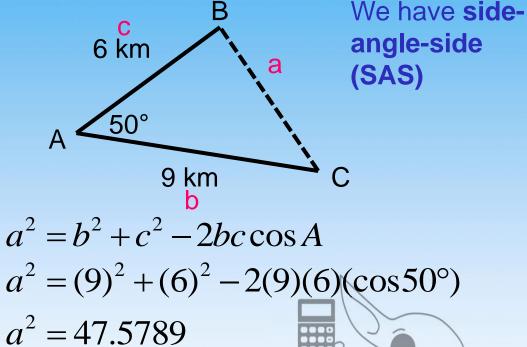
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Draw a diagram and solve for the unknown distance



 $\sqrt{a^2} = \sqrt{47.5789}$ 

a = 6.9

The hikers are 6.9 kilometres apart.

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

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

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

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

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

**EXAMPLE 4** (Page 40, #7)

Solving Problems using the Cosine Law

A motocross ramp is to be built for an upcoming race. The measures for the sides of the ramp are as shown. Calculate the *angle of inclination* of the ramp to

the nearest degree.

C

16.5 m

5.5 m

C

b

We are solving for this angle

The angle of inclination is **19°**.

We have side-side (SSS)  $\cos A = \frac{b^2 + c^2 - a^2}{a^2}$ 

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

$$\cos A = \frac{(16.0)^2 + (16.5)^2 - (5.5)^2}{2(16.0)(16.5)} \frac{\text{Inverse}}{\cos}$$

$$\cos A = \frac{256 + 272.25 - 30.25}{528}$$
 then  $\cos$ 

$$\cos A = \frac{498}{528}$$

$$\cos A = 0.9432$$

$$\angle A = \cos^{-1}(0.9432)$$

$$\angle A = 19^{\circ}$$

### CHAPTER 14THE COSINE LAW

# **Homework**

Page 39 – 41 #1ac, 2ac, 3 – 6, 8 – 10, 12a

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