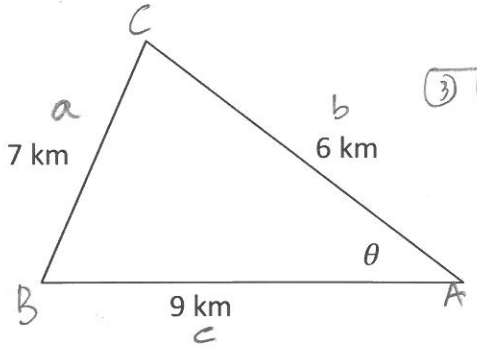
Using the Law of Cosines to find the Measure of an Unknown Angle

Just as with the Law of Sines, we can also use the Law of Cosines to find the size of an angle. In such cases, we must know all three sides and no angles.

Example 3

Determine the size of θ, to the nearest degree.



① label the sides and angles

② Given: $a = 7$ km, $b = 6$ km, $c = 9$ km — Find: $\angle A (\theta)$

③ Using:

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

substitute the give values

$$\cos A = \frac{6^2 + 9^2 - 7^2}{2(6 \times 9)}$$

$$\cos A = \frac{36 + 81 - 49}{108}$$

$$\cos A = \frac{68}{108}$$

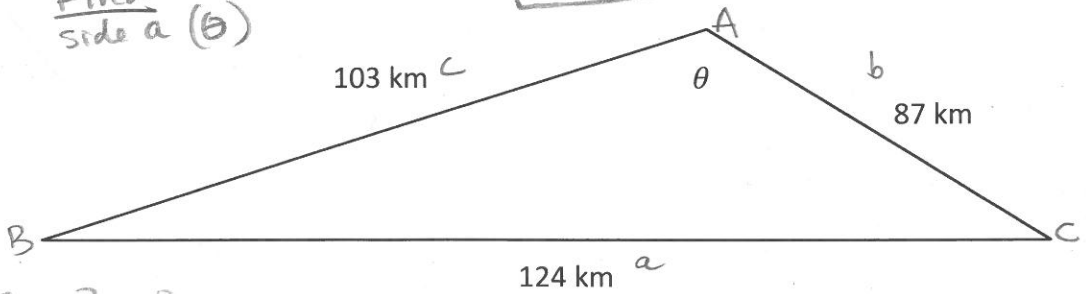
Using graphing calculator.

2nd [cos] (68 [÷] 108) [ENTER]

$$\theta = 50.98^\circ$$

Example 4

① Given: $a = 124$ km, $b = 87$ km, $c = 108$ km — Find: side a (θ)



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

③ $\cos A = \frac{87^2 + 103^2 - 124^2}{2(87 \times 103)}$ → $\cos A = \frac{7569 + 10609 - 15376}{17922}$

④ $\cos A = \frac{18178 - 15376}{17922} = \frac{2802}{17922}$

⑤ 2nd [cos] (2802 [÷] 17922) [ENTER]

$$\theta = 81.01$$