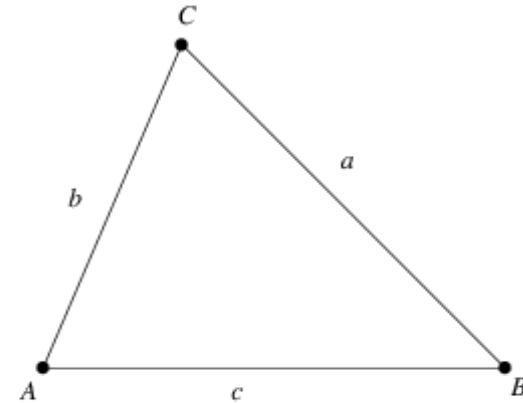


## 9-4 Law of Cosines

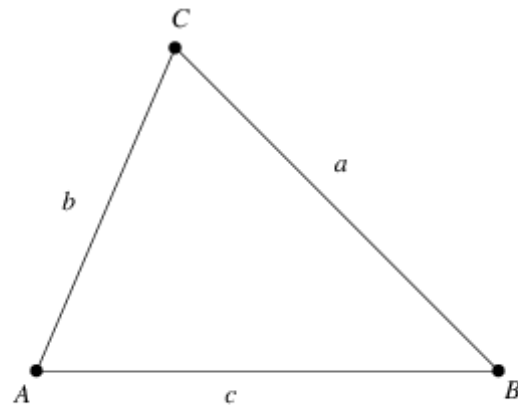
We saw how we could solve an oblique triangle using the law of sines if we have 2 angles and one side, or if we have the SSA situation. What happens if we have SSS or SAS?



We have the law of cosines.

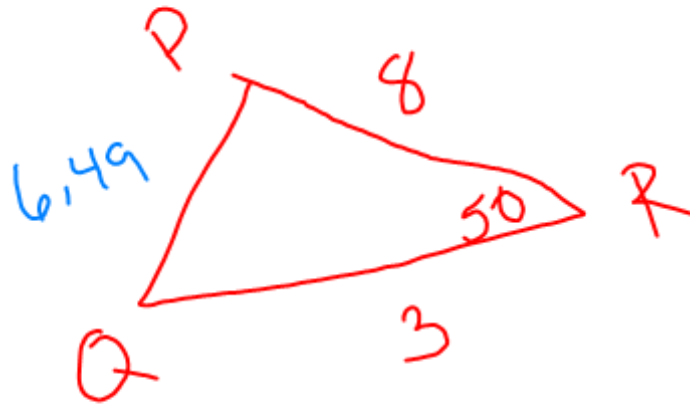
$$\text{In } \triangle ABC, c^2 = a^2 + b^2 - 2ab \cos C$$

$$\left( \begin{array}{c} \text{side} \\ \text{opposite} \\ \text{angle} \end{array} \right)^2 = \left( \begin{array}{c} \text{side} \\ \text{adjacent} \\ \text{to} \\ \text{angle} \end{array} \right)^2 + \left( \begin{array}{c} \text{other} \\ \text{side} \\ \text{adjacent} \\ \text{to angle} \end{array} \right)^2 - 2 \left( \begin{array}{c} \text{one} \\ \text{adjacent} \\ \text{side} \end{array} \right) \left( \begin{array}{c} \text{other} \\ \text{adjacent} \\ \text{side} \end{array} \right) \cos(\text{angle})$$



Example:

In  $\triangle PQR$ ,  $p = 3$ ,  $q = 8$ ,  $\angle R = 50^\circ$



$$r^2 = p^2 + q^2 - 2(p)(q) \cos R$$

$$r^2 = 3^2 + 8^2 - 2(3)(8) \cos 50^\circ$$

$$42.15 = r^2$$

$$r = 6.49$$

Example:

In  $\triangle ABC$ ,  $a = 5$ ,  $b = 6$ ,  $c = 7$ . Solve the triangle.

Which angle should we solve for first? Does it matter? What can we do after we solve for one angle?

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

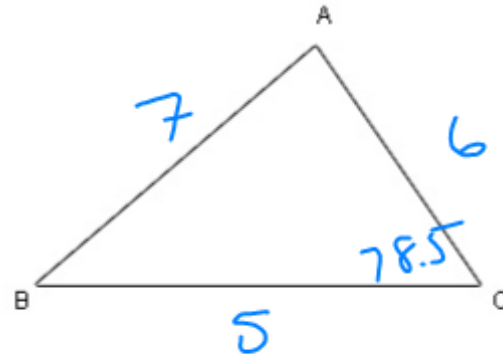
$$7^2 = 5^2 + 6^2 - 2(5)(6) \cos C$$

$$\frac{7^2 - 5^2 - 6^2}{-2(5)(6)} = \cos C$$

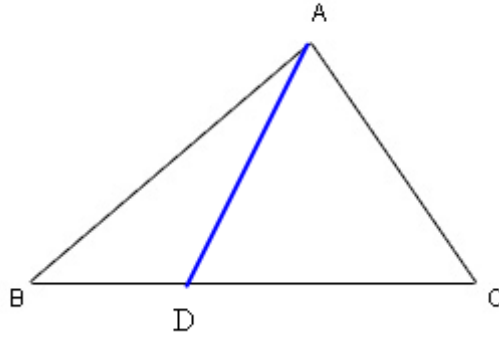
$$\angle C = 78.5^\circ$$

$$\frac{\sin 78.5}{7} = \frac{\sin B}{6}$$

$$\angle B = 57.1^\circ$$



$AB = 5$ ,  $BD = 2$ ,  $DC = 4$  and  $CA = 7$ . Find  $AD$ .



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