

Section 6.2 = Law of Cosines DAY TWO

Remember the Law of Cosines?

We used it to find a side given SAS.Could we find an angle given **SSS**? Yes, we could use the Law of Cosines! ☺

Solve for angle C.

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

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

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

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

MEMORIZE: THE LAW OF COSINESFor ANY triangle ABC , where a , b , and c are the lengths of the sides OPPOSITE the angles with measures A , B , and C (respectively)...

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

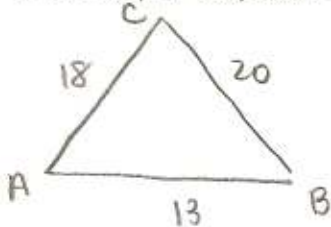
$$\text{so } C = \cos^{-1} \left(\frac{a^2 + b^2 - c^2}{2ab} \right)$$

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

$$\text{so } B = \cos^{-1} \left(\frac{a^2 + c^2 - b^2}{2ac} \right)$$

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

$$\text{so } A = \cos^{-1} \left(\frac{b^2 + c^2 - a^2}{2bc} \right)$$

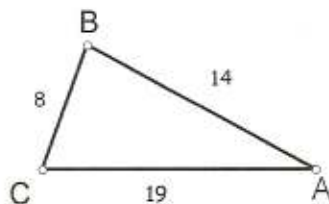
Generally, since not every triangle is labeled A, B, C :The measure of a missing angle = sum of squares of adjacent sides - square of side opposite the \angle , all divided by twice the product of 2 adjacent sides.(Note: we must have **SSS** to use this formula.)Examples: Find angle A in triangle ABC .1. $a = 20$, $b = 18$, and $c = 13$ 

$$20^2 = 18^2 + 13^2 - 2(18)(13) \cos A$$

$$A = \cos^{-1} \left(\frac{20^2 - 18^2 - 13^2}{-2(18)(13)} \right)$$

$$\boxed{A \approx 79^\circ}$$

2. Solve the following triangle.



$$14^2 = 8^2 + 19^2 - 2(8)(19)\cos C$$

$$C \approx 41^\circ \text{ STORE!}$$

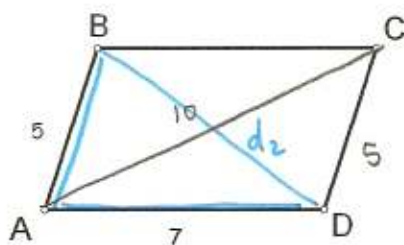
$$8^2 = 14^2 + 19^2 - 2(14)(19)\cos A$$

$$A \approx 22^\circ \text{ STORE!}$$

$$B = 180^\circ - C - A$$

$$B \approx 117^\circ$$

3. Given the following parallelogram, find the measures of the angles and the other diagonal, if $AC = 10$.



$$10^2 = 5^2 + 7^2 - 2(5)(7)\cos D$$

$$D \approx 112^\circ \text{ STORE!}$$

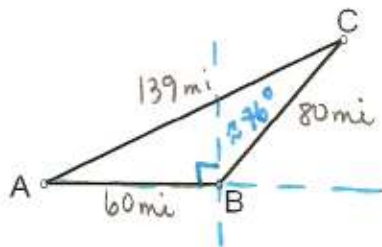
$$\text{so } C \approx 68^\circ, A \approx 68^\circ, B \approx 112^\circ$$

$$\sqrt{(d_2)^2} = \sqrt{5^2 + 7^2 - 2(5)(7)\cos A}$$

$$d_2 \approx 6.9$$

Example 4: WORD PROBLEM.

A ship travel 60 miles due east, then adjusts its course northward. After traveling 80 miles in that direction, the ship is 139 miles from its point of departure. Describe the bearing of the ship from point B to point C.



$$139^2 = 60^2 + 80^2 - 2(60)(80)\cos B$$

$$B \approx 166^\circ \text{ STORE!}$$

$$N76^\circ E \text{ or } E14^\circ N$$

Example 5: WORD PROBLEM.

A 150-foot vertical tower is to be erected on the side of a hill that makes a 5° angle with the horizontal. Find the length of the two guy wires that will be needed to anchor the base 100 feet uphill and 100 feet downhill.

$$\sqrt{y^2} = \sqrt{150^2 + 100^2 - 2(150)(100)\cos 85^\circ}$$

$$y \approx 172.87 \text{ feet}$$

$$\sqrt{x^2} = \sqrt{100^2 + 150^2 - 2(150)(100)\cos 95^\circ}$$

$$x \approx 187.39 \text{ feet}$$

