Sunday, April 07, 2019
4:50 PM

KEY

6.2 B Law of Cosines

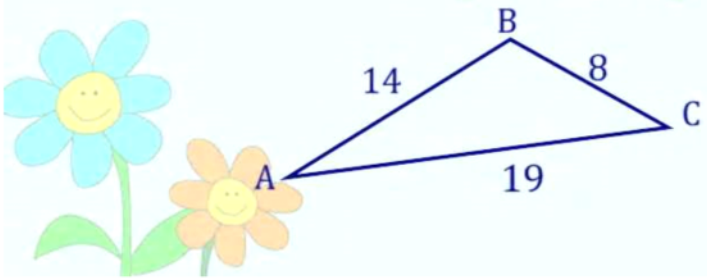
Homework:
- pg 443 #1,7,23,25
- Quiz 6.1-6.2 -
- Optional 6.1VC and 6.2VC

Objective:

SWBAT: Use the Law of Cosines to solve oblique triangles (SSS & SAS)

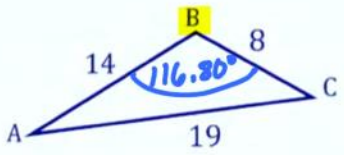
Do Now: Can we apply the Law of Sines to the given triangle?

NO



Example 1: Solve ΔABC (round to 2 decimal places)

SSS



Important Note:
When given SSS triangle, solve for the
☆ **largest angle FIRST** ☆
using the ***Law of Cosines***!!
Then use ***Law of Sines*** to find
the other two acute angles.

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

$\cos B = \frac{(8)^2 + (14)^2 - (19)^2}{2(8)(14)}$

$\cos^{-1}(-.45089) = B$ ← STO

$B \approx 116.80°$

$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{8}{\sin A} = \frac{19}{\sin 116.8°}$

$\sin A = \frac{8 \sin 116.8°}{19}$ ← STO

$\sin^{-1}(.3758) = A$

$A \approx 22.08°$

$C = 180° - A - B$

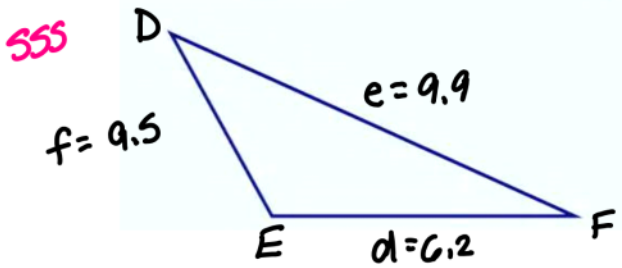
$C = 180° - 22.08° - 116.8°$

$C \approx 41.12°$

Hints:
1.) *Don't forget to use **parentheses**!*
2.) ***Store** values that you will later use for another calculation!!*

Example 2: Solve ΔDEF given $d = 6.2, e = 9.9, f = 9.5$

SSS



* use Law of Cosines to find largest ∠

$$\cos E = \frac{d^2 + f^2 - e^2}{2df}$$

$$\cos E = \frac{(6.2)^2 + (9.5)^2 - (9.9)^2}{2(6.2)(9.5)}$$ ← STO

$$\cos^{-1}(.26044) = E$$ ↖ STO

$E \approx 74.90°$

$$\frac{d}{\sin D} = \frac{e}{\sin E}$$

$$\frac{6.2}{\sin D} = \frac{9.9}{\sin 74.90°}$$

$$\sin D = \frac{6.2 \sin 74.90°}{9.9}$$ ← STO

$\sin^{-1}(.6046) = D$

$D \approx 37.20°$

$F = 180° - E - D$

$F \approx 180° - 74.9° - 37.20°$

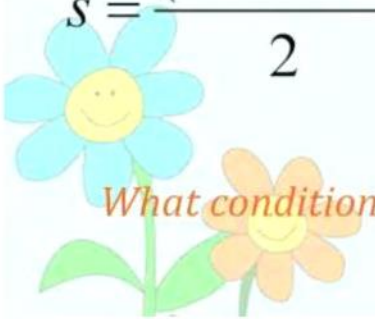
$F \approx 67.89°$

Heron's Area Formula

If ABC is a triangle with sides a, b, and c, then:

$$Area = \sqrt{s(s-a)(s-b)(s-c)}$$ where

$$s = \frac{(a+b+c)}{2}$$ *(s is the semi-perimeter)*



What condition must exist to use Heron's Formula?

SSS

Use ***Heron's Area Formula*** to find the area of the triangle given:

$$Area = \sqrt{s(s-a)(s-b)(s-c)}$$

$$s = \frac{(a+b+c)}{2}$$

1.) $a = 12, b = 15, c = 9$

$s = \frac{12+15+9}{2}$

$s = 18$

$A = \sqrt{18(18-12)(18-15)(18-9)}$

$A = \sqrt{2916}$

$A = 54$ sq units

2.) $a = 75.4, b = 52, c = 52$

$s = \frac{75.4 + 52 + 52}{2}$

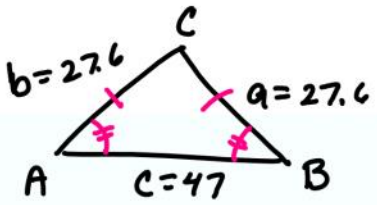
$s = 89.7$

$A = \sqrt{89.7(89.7-75.4)(89.7-52)(89.7-52)}$

$A = \sqrt{1,823,102.896}$ ← STO

$A \approx 1350.2$ sq units

Your turn...



SSS
* solve for largest ∠ 1st!

1.) Solve ΔABC given $a = 27.6, b = 27.6, c = 47$

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

$\cos C = \frac{(27.6)^2+(27.6)^2-47^2}{2(27.6)(27.6)}$

$\cos^{-1}(-.44993) = C$ ← STO

$C \approx 116.74°$

$\frac{a}{\sin A} = \frac{c}{\sin C}$

$\frac{27.6}{\sin A} = \frac{47}{\sin 116.74°}$

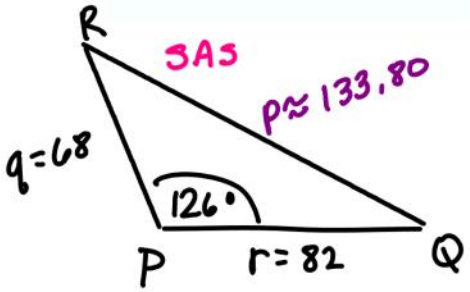
$\sin A = \frac{27.6 \sin 116.74°}{47}$

$A \approx 31.63°$

A=B because sides are equal

$B \approx 31.63°$

2.) Solve ΔPQR given $P = 126°, q = 68, r = 82$



$p^2 = q^2+r^2-2qr\cos P$

$p^2 = (68)^2+(82)^2-2(68)(82)\cos 126°$

$p^2 = 17902.98113$ ← STO

$p \approx 133.80$

$\cos R = \frac{p^2+q^2-r^2}{2pq}$

$\cos R = \frac{(133.8)^2+(68)^2-(82)^2}{2(133.8)(68)}$

$\cos^{-1}(.8684186) = R$ ← STO

$R \approx 29.72°$

$Q = 180° - P - R$

$Q = 180° - 126° - 29.72°$

$Q \approx 24.28°$

OR

* Use Law of Sines, since given an obtuse ∠

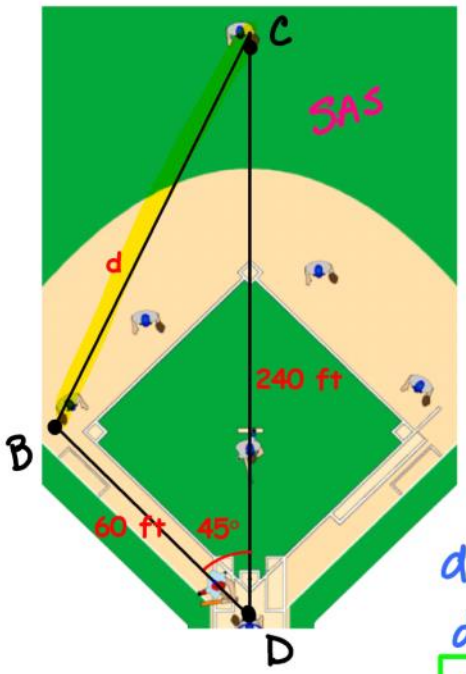
$\frac{p}{\sin P} = \frac{q}{\sin Q}$

$\frac{133.80}{\sin 126°} = \frac{68}{\sin Q}$

$\sin Q = \frac{68 \sin 126°}{133.8}$

$Q \approx 24.28°$

Applications:



A centerfielder in a softball game fields the ball and throws to third plate. If the distance from the centerfielder to home plate is 240 feet and the distance between bases is 60 feet, how far did the centerfielder throw the ball?

$d^2 = b^2 + c^2 - 2bc \cos D$

$d^2 = (240)^2 + (60)^2 - 2(240)(60)\cos 45°$

$d^2 = 40835.3247$

$d \approx 202$ feet

Summary:

- Law of Sines only works with AAS, ASA, SSA.
- Law of Cosines works with SSS, SAS
- Law of Cosines: $c^2 = a^2 + b^2 - 2ab \cos C$

  the first part is the Pythagorean Thm; then 2*ab[Cos]c

- Only one formula needed – MEMORIZE. Plug all info into this, then solve for angle.

- The Law of Cosines is a form of Pythagorean Thm

- YOU DO NOT KNOW IF YOU HAVE AN OBTUSE ANGLE USING SINE.

- Only one obtuse angle in Δ, so find largest angle first then use Law of Sines or Law of Cosines to find remaining (acute) angles. Law of Sines is easier to use, but dependent upon previously found values (therefore MAY be incorrect)

- When using Law of COSINES, find LARGEST ANGLE FIRST!!! If you use the Law of SINES, find the SMALLEST ANGLES FIRST!!!