6.2 Law of Cosines

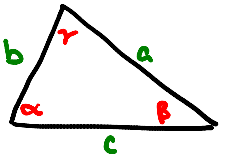
Wednesday, April 15, 2015
11:15 AM

Law of Cosines is used for SSS or SAS when solving oblique triangles.

Law of Cosines

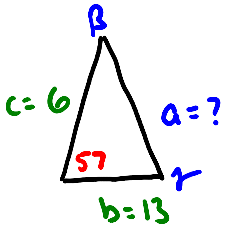
For a Δ with sides $a, b,$ and c and opposite angles $\alpha, \beta,$ and γ.

$$c^2 = a^2 + b^2 - 2ab\cos\gamma$$
$$b^2 = a^2 + c^2 - 2ac\cos\beta$$
$$a^2 = b^2 + c^2 - 2bc\cos\alpha$$



Ex.1 Solve for the missing info:

a)



Side a

$a^2 = b^2 + c^2 - 2bc\cos\alpha$

$a^2 = (13)^2 + (6)^2 - 2(13)(6)\cos 57$

$a^2 = 120.0363$

$a = 10.96$

β

$b^2 = a^2 + c^2 - 2ac\cos\beta$

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

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

$$\cos\beta = \frac{a^2 + c^2 - b^2}{2ac} \rightarrow \cos\beta = \frac{(10.96)^2 + (6)^2 - (13)^2}{2(10.96)(6)} \rightarrow \cos\beta = -.0979$$

$\beta = 95.6°$

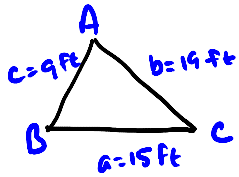
γ

$180 - (95.7 + 57)$

$27.4°$

* When you have to use the Law of Cosines, ALWAYS solve for the largest angle (the one opposite of the largest side). Then you can use the Law of Sines to finish.

b) $a = 15$ ft $\quad b = 19$ ft $\quad c = 9$ ft



β

$b^2 = a^2 + c^2 - 2ac\cos\beta$

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

α

$a^2 = b^2 + c^2 - 2bc\cos\alpha$

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

D a=15ft

$\frac{}{2ac}$ $\frac{}{2bc}$

$\cos\beta = \frac{(15)^2 + (9)^2 - (19)^2}{2(15)(9)}$ $\cos\alpha = \frac{(19)^2 + (9)^2 - (15)^2}{2(19)(9)}$

$\cos\beta = -.2037$ $\cos\alpha = .6345$

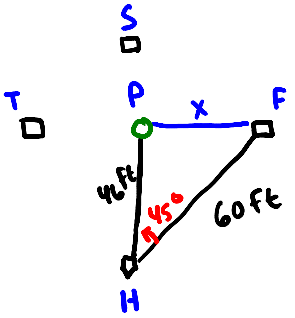
$\beta = 101.8°$ $\alpha = 50.6°$

γ

$180 - (101.8 + 50.6) = 27.6°$

Ex. 2 Applications of Law of Cosine

a) The pitcher's mound on a softball field is 46 ft from home plate and the distance between the bases is 60 ft. (The pitcher's mound is not halfway between home plate and 2nd base).
How far is the pitcher's mound from first base?

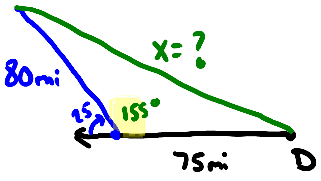


$x^2 = (46)^2 + (60)^2 - 2(46)(60)\cos 45$

$x^2 = 1812.77$

$x \approx 42.58$ ft

b) A ship travels 75 mi due west, then adjusts its course 25° northward. After traveling 80 mi in the new direction, how far is the ship from its departure point?



$x^2 = (80)^2 + (75)^2 - 2(80)(75)\cos 155$

$x^2 = 22,900.6934$

$x \approx 151.33$ mi

Heron's Formula

$A = \sqrt{s(s-a)(s-b)(s-c)}$ $\quad s = \frac{a+b+c}{2}$

Ex. 3 Use Heron's Formula

Ex. 3 Use Heron's Formula

a) sides are 8, 15, and 21 inches

$s = \frac{8+15+21}{2}$

$s = 22$

$A = \sqrt{22(22-8)(22-15)(22-21)}$

$A = \sqrt{2156}$

$A = 46.43 \text{ in}^2$

HW 6.1 Tb pg 434 #s 23-27, 29-31

6.2 Tb pg. 441 #'s 2-6ew, 10, 18, 20, 25, 27