

homework Questions

17
27
19

$A = 30$ $a =$
 $B = 100$ $b = 44$
 $C = 50$ $c =$

$$\frac{\sin(100)}{44} = \frac{\sin(30)}{a}$$

$$\frac{44 \cdot \sin 30}{\sin 100} = a$$

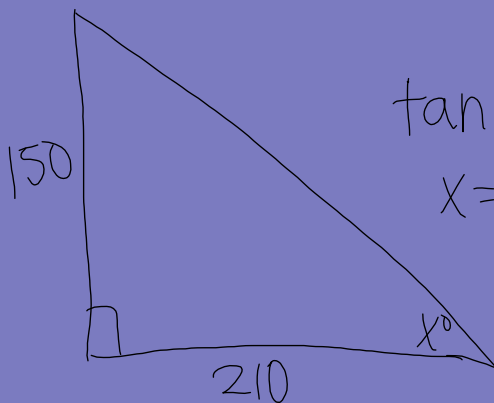
(19)

$$\frac{\sin(124)}{15.4} = \frac{\sin X}{9.1}$$

$$\frac{9.1 \cdot \sin(124)}{15.4} = \sin X$$

$$.48 = \sin X$$

(27)



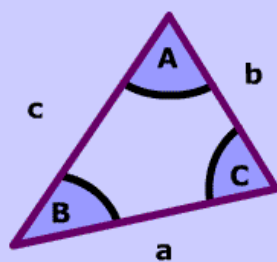
$$\tan X = \frac{150}{210}$$

$$X = \tan^{-1}\left(\frac{150}{210}\right)$$

14.5 Law of Cosines

Law of Cosines Formula

Law of Cosines



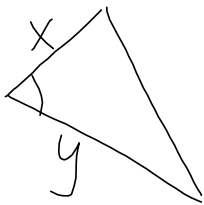
$$a^2 = b^2 + c^2 - 2bc \cdot \cos(A)$$

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

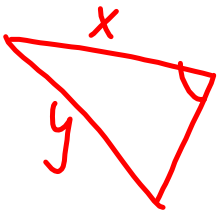
$$c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$$

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You can use the Law of Cosines to find missing measures in any triangle when you know:



- two sides and the angle between them, (SAS)
- all three sides (SSS)



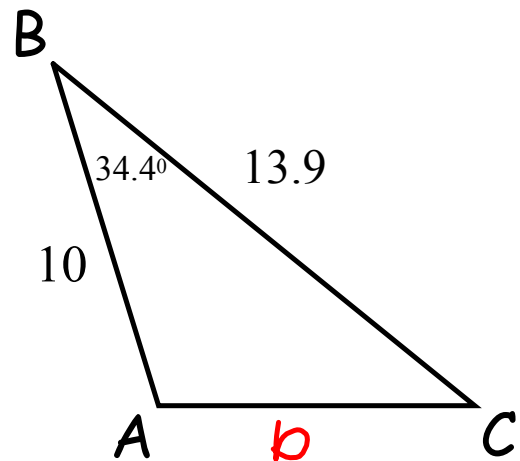
Example #1: (given SAS) Solve for b .

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

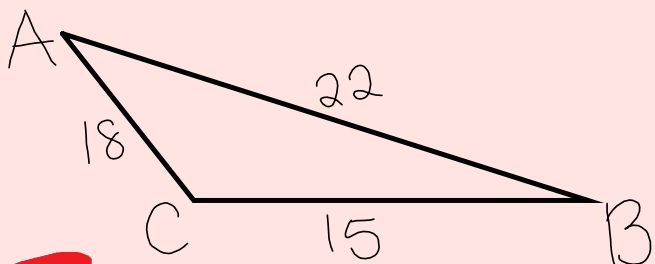
$$b^2 = 13.9^2 + 10^2 - 2(13.9)(10)\cos 34.4^\circ$$

$$\sqrt{b^2} = \sqrt{63.83}$$

$$b = 8.0$$



If given SSS:



1 → $a^2 = b^2 + c^2 - (2bc \cos A)$
 $15^2 = 18^2 + 22^2 - (2 \cdot 18 \cdot 22 \cdot \cos A)$

2 → $\frac{15^2 - 18^2 - 22^2}{-2 \cdot 18 \cdot 22} = \cos A$

$\frac{-583}{-792} = \cos A$

3 → $A = 42.6^\circ$

Example #2:

$a = 15, b = 18, c = 22$

(HINT: Draw the triangle.)

$$22^2 = 15^2 + 18^2 - 2(15)(18)\cos C$$

$$\frac{22^2 - 15^2 - 18^2}{-2 \cdot 15 \cdot 18} = \cos C$$

$$\cos^{-1}(-65/-540) = 83.1^\circ$$

$$15^2 = 18^2 + 22^2 - 2(18)(22)\cos A$$

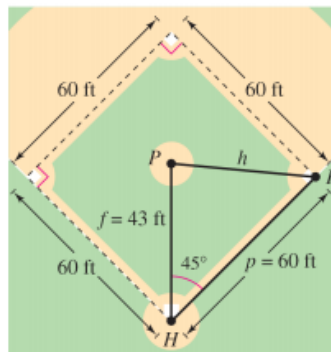
$$\frac{15^2 - 18^2 - 22^2}{-2 \cdot 18 \cdot 22} = \cos A$$

$$\cos^{-1}(-583/-792) = 42.6^\circ$$

$$A = 42.6^\circ$$

$$B = 54.3^\circ$$

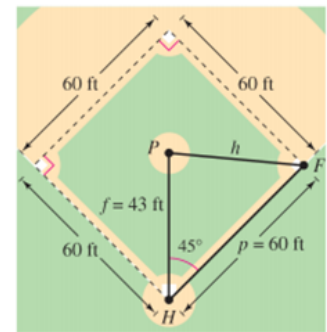
- 3) The pitcher's mound on a women's softball field is 43 feet from home plate and the distance between the bases is 60 feet, as shown in Figure 6.13. (The pitcher's mound is not halfway between home plate and second base.) How far is the pitcher's mound from first base?



SOLUTION

Using the Law of Cosines for this SAS case, you have

$$\begin{aligned}h^2 &= f^2 + p^2 - 2fp \cos H \\&= 43^2 + 60^2 - 2(43)(60) \cos 45^\circ \\&\approx 1800.3.\end{aligned}$$

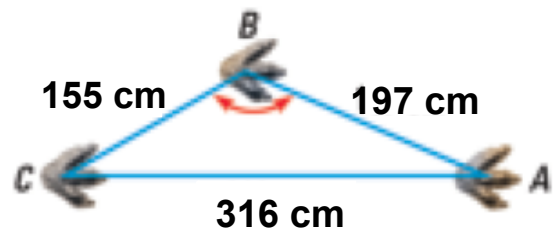


So, the approximate distance from the pitcher's mound to first base is

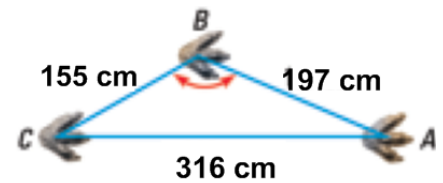
$$h \approx \sqrt{1800.3} \approx 42.43 \text{ feet.}$$

4)

Scientists can use a set of footprints to calculate an organism's *step angle*, which is a measure of walking efficiency. The closer the step angle is to 180° , the more efficiently the organism walked.



The diagram at the right shows a set of footprints for a dinosaur. Find the step angle B .

**SOLUTION**

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

Law of cosines

$$316^2 = 155^2 + 197^2 - 2(155)(197) \cos B$$

Substitute.

$$\frac{316^2 = 155^2 + 197^2}{-2(155)(197)} = \cos B$$

Solve for $\cos B$.

$$-0.6062 \approx \cos B$$

Simplify.

$$B \approx \cos^{-1}(-0.6062) \approx 127.3^\circ$$

Use inverse cosine.

ANSWER The step angle B is about 127.3° .

HW14.5 Law of Cosines

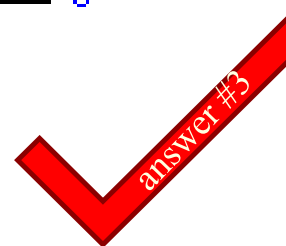
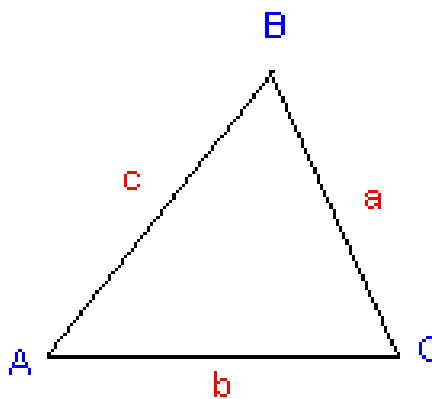
p. 810 #1-17 odd, 24-27 all

(13-17) keep using
Law of cosines

EXTRA PROBLEMS
for more practice
or
warmups

Solve for the angles in triangle ABC.

$$\begin{aligned} 3) \quad a &= 28 \\ b &= 52 \\ c &= 25 \end{aligned}$$



Solve for the missing sides
and angles in $\triangle ABC$.

$$4) C = 54^\circ$$

$$a = 112$$

$$b = 87.2$$



