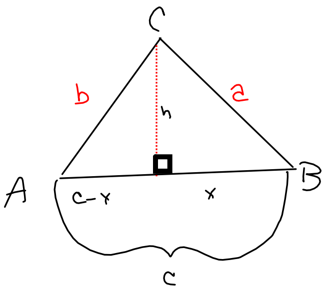


$$a^2 = x^2 + h^2$$
$$= (a\cos B)^2 + (a\sin B)^2$$
$$= a^2\cos^2 B + a^2\sin^2 B$$
$$= a^2\left(\frac{x}{a}\right)^2 + a^2\left(\frac{h}{a}\right)^2$$

$$\frac{x}{a} = \cos B \qquad \frac{h}{a} = \sin B \Rightarrow$$
$$\Rightarrow x = a\cos B \qquad h = = a\sin B$$

3.3#27

$2\bar{i} - 2\bar{j} = \langle 2,-2\rangle = \bar{v}$

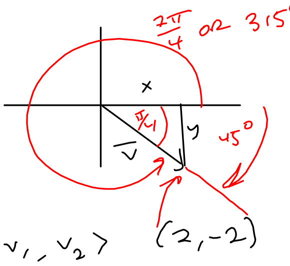
$\bar{i} = \langle 1,0\rangle,\ \bar{j} = \langle 0,1\rangle$

$2\bar{i} - 2\bar{j} = 2\langle 1,0\rangle - 2\langle 0,1\rangle$ } Scalar multiplication times vector.

$= \langle 2,0\rangle + \langle 0,-2\rangle$

$= \langle 2+0, 0-2\rangle = \langle 2,-2\rangle$ Vector addition, entry by entry.

Generally $\arctan\left(\frac{y}{x}\right)$ & then make sure of quadrant.



Direction angle is POSITIVE angle measured from positive x-axis.

So $\boxed{\theta = 315^\circ}$

Magnitude

$\bar{v} = \langle v_1, v_2\rangle$

$\|\bar{v}\| = \sqrt{v_1^2 + v_2^2}$ is Euclidean magnitude (or "norm") of $\bar{v}$.

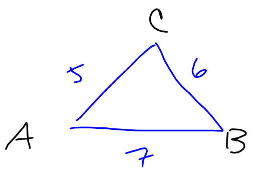
$= \sqrt{2^2 + (-2)^2} = \sqrt{4+4} = \sqrt{8}$

$= \sqrt{4\cdot 2} = \sqrt{4}\sqrt{2} = \boxed{2\sqrt{2} = \|\bar{v}\|}$

$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$ Absolute Value $|-3| = -(-3) = 3$

$|5| = 5$

Law of cosines handles SSS case.



Law of Sines needs at least one angle.

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

Book gives separate formula for finding angle A

$$\Rightarrow a^2 - b^2 - c^2 = -2bc\cos A$$

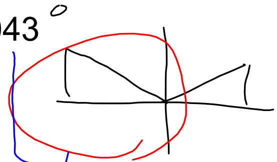
$$\Rightarrow \frac{b^2+c^2-a^2}{2bc} = \cos A$$

$$\cos A = \frac{5^2+7^2-6^2}{2(5)(7)} = \frac{25+49-36}{70} = \frac{38}{70}$$

$$\underbrace{\arccos(\cos A)}_{} \approx \arccos\left(\frac{38}{70}\right) \approx 57.12165043^\circ$$

Hesitant to ~~call this A, b/c arccosine's range.~~

Now that we have A & all 3 sides, use Law of Sines for the rest!

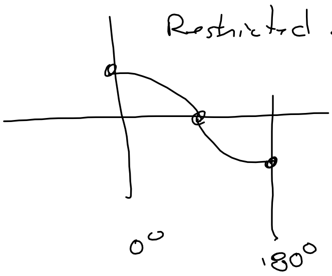


arctangent doesn't see this

No. Not for arccosine. Not for triangles

This means $\arccos(\cos A) = A$!
we don't have to play the $180^\circ - \arctan(*)$ game.

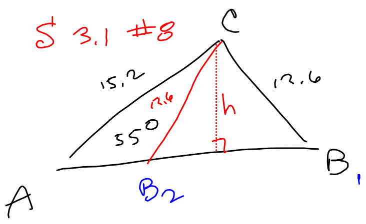
Restricted cosine



Because $0 \le \theta \le 180$ in a triangle.

Sine isn't as nice. It can't handle obtuse angles. So you have to be aware of that possibility.

§ 3.1 #8



12.45111108

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

$$\sin B = \frac{b \sin A}{a} = \frac{15.2 \sin(55^\circ)}{12.6} \approx .9881834185 \Rightarrow$$

B_1 = smaller "B" $\approx \boxed{81.18317653^\circ \approx B_1}$, via arcsin(previous)

wait! Didn't even check to see if or how many solutions exist.

$\frac{h}{15.2} = \sin(55^\circ) \Rightarrow h = 15.2 \sin(55^\circ) \approx 12.45111108 < 12.6$

$\Rightarrow$ at least one solution & $12.6 < 15.2 \Rightarrow \exists\ 2$!

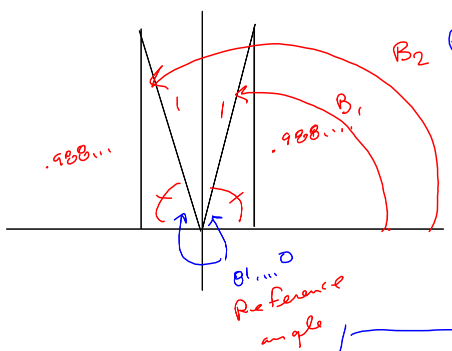
There are

$C = 180^\circ - A - B \approx 180^\circ - 55^\circ - 81.18317653$
$= \boxed{43.81682347^\circ \approx C_1}$

$$\frac{c}{\sin C} = \frac{a}{\sin A} \Rightarrow c = \frac{a \sin C}{\sin A} \approx \frac{12.6 \sin(43.\ldots^\circ)}{\sin(55^\circ)}$$

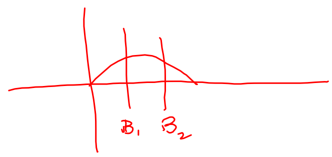
$\approx \boxed{10.64963940 \approx c_1}$

Now find the triangle for the BIG B. (B_2 is obtuse!)



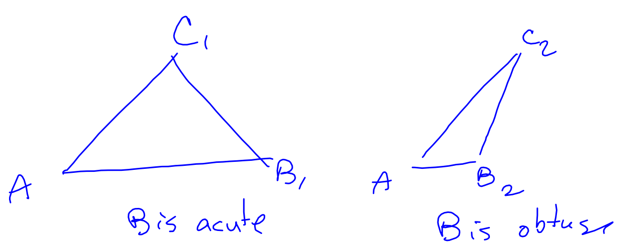
Both B_1 & B_2 satisfy

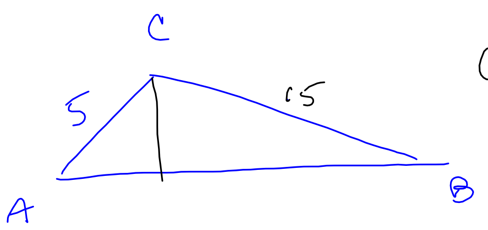
$\sin(B) \approx .9881834185$



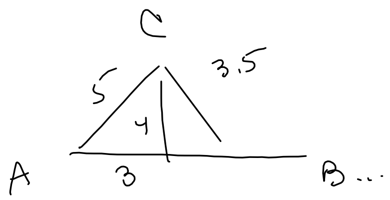
$B_2 = 180 - B_1 \approx \boxed{98.81682347^\circ \approx B_2}$

Now, $C_2 = 180^\circ - B_2 - 55^\circ \approx \boxed{26.18317653^\circ \approx C_2}$

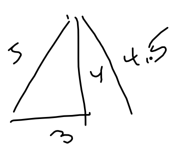




Clearly only one solution



No Solution!

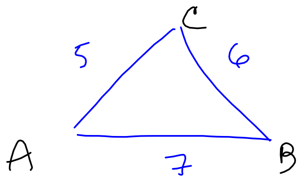


2 solutions

A bit of a cheat to get around Law of Cosines using Heron's Formula! SSS case!

$\text{Area} = \frac{1}{2}bc\sin A$, so if we could just get at $\sin A$...

Heron's says. $\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$



$s = \frac{a+b+c}{2} = \frac{5+6+7}{2} = \frac{18}{2} = 9$

$\text{Area} = \sqrt{9(9-5)(9-6)(9-7)} = \sqrt{9(4)(3)(2)}$

$= 6\sqrt{6}$ ⟶

$\frac{1}{2}bc\sin A = \frac{1}{2}(5)(6)\sin A = 15\sin A = 6\sqrt{6}$

$\sin A = \frac{6\sqrt{6}}{15}$ ⟶ you can find A! This works perfectly for A acute.

From then on, you can use law of sines, bypassing law of cosines. Just understand that I will REQUIRE Law of Cosines on the test,