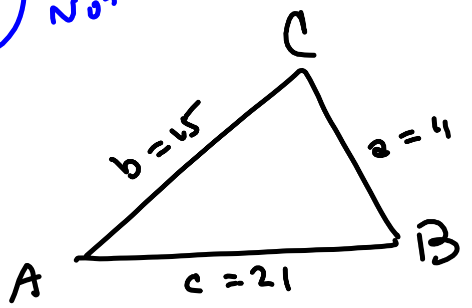
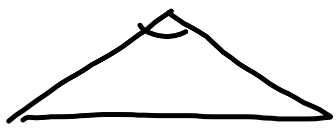
#13 Not asked ∡ sight 4, 15, 21





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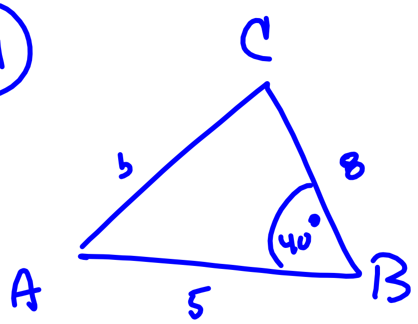


$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$b^2 = 8^2 + 5^2 - 2(5)(8)\cos 40^\circ$$

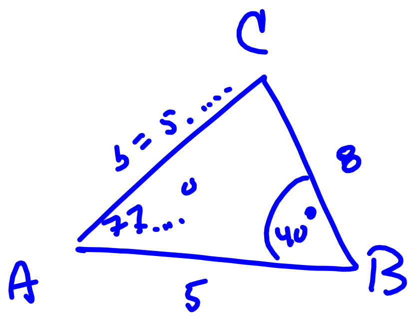
$$= 64 + 25 - 80\cos 40^\circ$$

$$= 89 - 80\cos 40^\circ$$

$$89 - 80\cdot\cos\left(\frac{40\cdot \mathrm{Pi}}{180}\right) \approx 89 - 80\cos\left(\frac{2}{9}\pi\right)$$

$$evalf(\%) \approx 27.71644455 \approx b^2$$

$$\Rightarrow b \approx 5.264640971$$

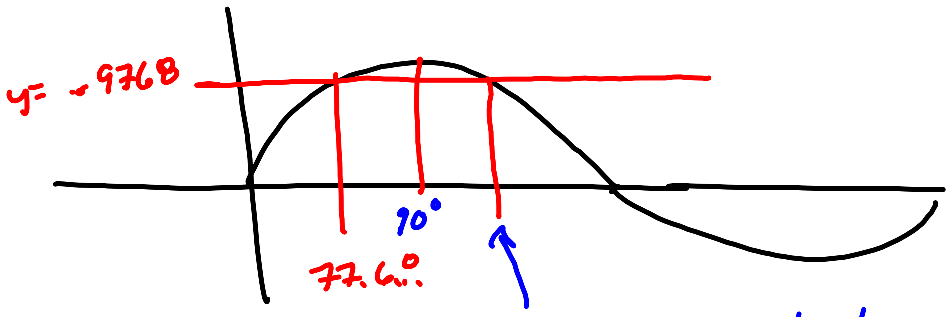


$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\sin A = \frac{a \sin B}{b} \approx \frac{8 \sin 40°}{5....} \approx 0.9767619302$$

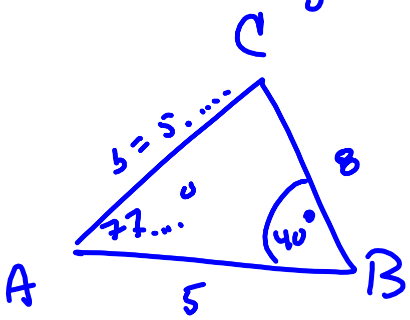
$$\Rightarrow A \approx \sin^{-1}(0.9767619302)$$

$$\approx 77.62394369°$$



102.3760563 is book answer for A.

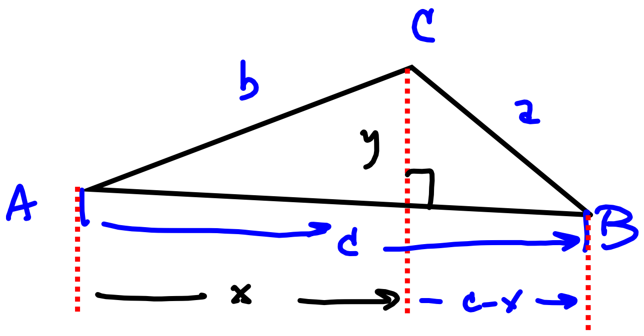
why?



By previous work, this puts C close to 63°. But C needs to be the smallest angle, since $c = 5$ is the shortest side.

The resolution to this is the 102.37...° that also satisfies

$\sin A \approx .9768$ (See picture above.)



Pythagorus said that

$a^2 = (c-x)^2 + y^2$

$= (x-c)^2 + y^2$

$= (b\cos A - c)^2 + (b\sin A)^2$

$(r+s)^2 = r^2 + 2rs + s^2$

$\frac{x}{b} = \cos A$

$x = b\cos A$

$\frac{y}{b} = \sin A$

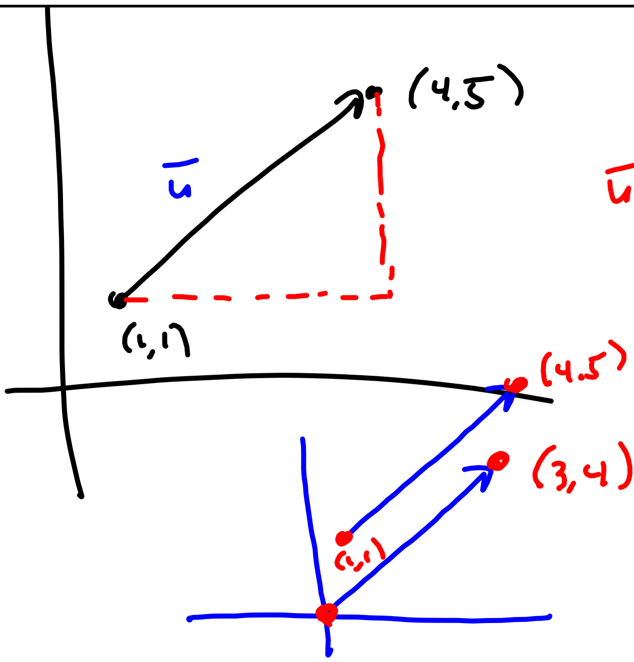
$y = b\sin A$

$(r-s)^2 \stackrel{?}{=} r^2 - 2rs + s^2$

$= \underline{b^2\cos^2 A} - 2(b\cos A)c + c^2 + \underline{b^2\sin^2 A}$

$= b^2(\cos^2 A + \sin^2 A) - 2bc\cos A$

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



$\bar{u} = \langle 4-1, 5-1 \rangle$

$= \langle 3, 4 \rangle$

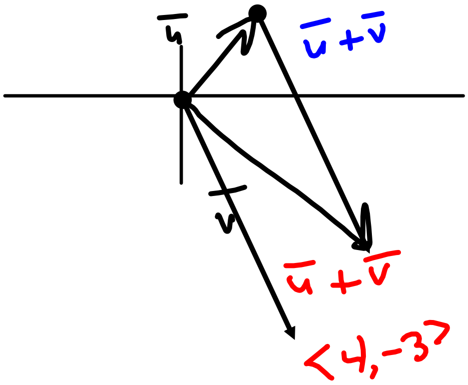
$\bar{u} + \bar{v}$

$\bar{u} = \langle u_1, u_2 \rangle = \langle 1, 2 \rangle$

$\bar{v} = \langle v_1, v_2 \rangle = \langle 3, -5 \rangle$

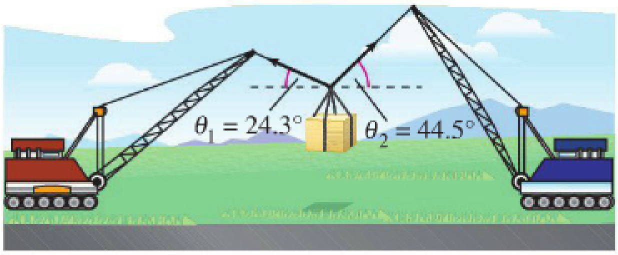
$\bar{u} + \bar{v} = \langle u_1 + v_1, u_2 + v_2 \rangle$

$= \langle 4, -3 \rangle$

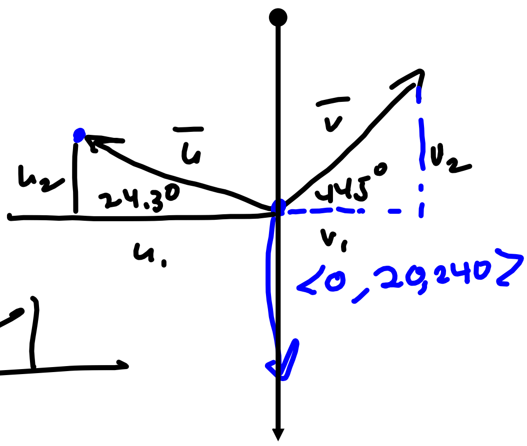


$\bar{u} + \bar{v}$ is called the RESULTANT

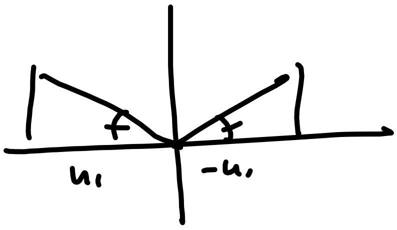
89. Cable Tension The cranes shown in the figure are lifting an object that weighs 20,240 pounds. Find the tension in the cable of each crane.



90. Cable Tension Repeat Exercise 89 for $\theta_1 = 35.6°$ and $\theta_2 = 40.4°$.



We want the resultant to have an upward component of 20,240 lbs



We know that $\bar{u} + \bar{v} = \langle 0, 2040\rangle$

$u_1 + v_1 = 0$ $\qquad$ $u_2 + v_2 = 2040$

$\dfrac{u_2}{\|\bar{u}\|} = \sin 24.3^0$ $\qquad$ $v_2 = \|\bar{v}\| \sin 44.5^0$

$u_2 = \|\bar{u}\| \sin 24.3^0$

$$-\frac{u_1}{\|\bar{u}\|} = \cos 24.3^\circ \qquad \frac{v_1}{\|\bar{v}\|} = \cos 44.5^\circ$$

$$u_1 = -\|\bar{u}\| \cos 24.3^\circ \qquad v_1 = \|\bar{v}\| \cos 44.5^\circ$$

$\bar{u} + \bar{v} =$

$$\langle -\|\bar{u}\| \cos 24.3^\circ + \|\bar{v}\| \cos 44.5^\circ, \|\bar{u}\| \sin 24.3^\circ + \|\bar{v}\| \sin 44.5^\circ \rangle$$

$$= \langle 0, 2040 \rangle$$

$$\approx \langle 0.9114032766\|\bar{u}\| + 0.7132504491\,\|\bar{v}\|,$$

$$0.4115143587\|\bar{u}\| + 0.7009092643\,\|\bar{v}\|\rangle$$

So, $-.9114\ldots\,\|\bar{u}\| + .71\ldots\,\|\bar{v}\| = 0$

$$\|\bar{u}\| = \frac{-.71\ldots\|\bar{v}\|}{-.9114\ldots} \approx 0.7825849077\,\|\bar{v}\|$$

so $.4115\ldots\,\|\bar{u}\| + .7009\ldots\,\|\bar{v}\| = 20240$

$$(.4115\ldots)(.782\ldots\,\|\bar{v}\|) + .7009\ldots\,\|\bar{v}\| = 20240$$

$$ab\,\|\bar{v}\| + c\,\|\bar{v}\| = 20\,240$$

$$(ab+c)\,\|\bar{v}\| = 20\,240$$

$$\|\bar{v}\| = \frac{20\,240}{ab+c}$$

$a = .4115\ldots$

$b = .782\ldots$

$c = .7009\ldots$