$4\sin^2(2x) - 1 = 0$

$4\left(\frac{1-\cos(4x)}{2}\right) = 1$

$2(1-\cos 4x) = 1$

$1-\cos(4x) = \frac{1}{2}$

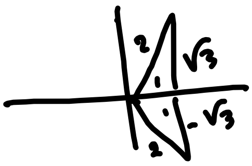
$-\cos(4x) = -\frac{1}{2}$

$\cos(4x) = \frac{1}{2}$

Midterm
#10

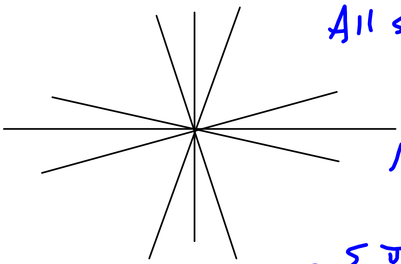
$x \in [0, 2\pi) \longrightarrow$
$2x \in [0, 4\pi)$
$4x \in [0, 8\pi)$

Power--Reduction Formula would also have worked, for this equation.



$4x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}, \quad \frac{11\pi}{3}, \frac{13\pi}{3}, \frac{17\pi}{3}, \frac{19\pi}{3}, \frac{23\pi}{3}$

$x \in \left\{\frac{\pi}{12}, \frac{5\pi}{12}, \frac{7\pi}{12}, \quad \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12}\right\} = A$



All sol'ns:

$\{y + 2n\pi \mid y \in A, n \in \mathbb{Z}\}$

Note that $\frac{\pi}{12}$ & $\frac{13\pi}{12}$, etc are on the same line:

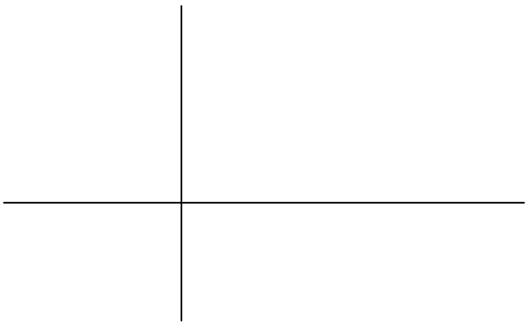
$x \in \left\{\frac{\pi}{12} + n\pi, \frac{5\pi}{12} + n\pi, \frac{7\pi}{12} + n\pi, \frac{11\pi}{12} + n\pi \mid n \in \mathbb{Z}\right\}$

or just

$x = \frac{\pi}{12} + n\pi, \frac{5\pi}{12} + n\pi, \frac{7\pi}{12} + n\pi, \frac{11\pi}{12} + n\pi, \quad n \in \mathbb{Z}.$

3.3 Questions?

Section 3.4:



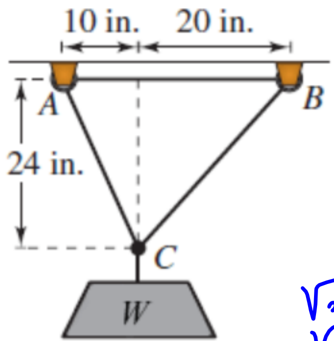
3.3 APPS

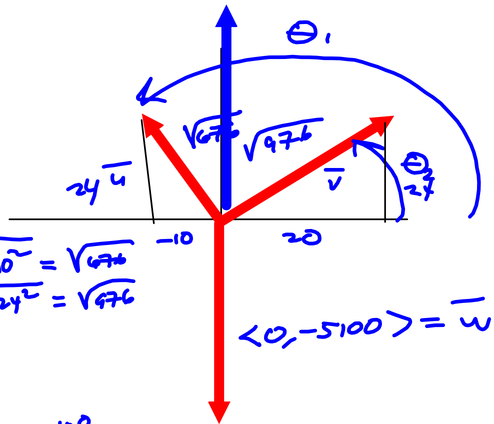
Use the figure to determine the tension in each cable supporting the load. (Round your answers to one decimal point.)

W = 5100 lb

tension in $\overline{AC}$ ✗ 3683.3 lb 3683.33333333

tension in $\overline{BC}$ ✗ 2212.9 lb 2212.90407484





24 × 24 = 96 + 480 = 576

2 | 576, 2 | 288, 12 | 144, 12

$\sqrt{24^2+10^2} = \sqrt{676}$

$\sqrt{20^2+24^2} = \sqrt{976}$

$\langle 0, -5100 \rangle = \bar{w}$

400 + 576 = 976

$\bar{u} = \|\bar{u}\| \langle \cos\theta_2, \sin\theta_2 \rangle$

$= \|\bar{u}\| \langle \frac{-10}{\sqrt{676}}, \frac{24}{\sqrt{676}} \rangle$

$= a \langle \quad \rangle$

$\bar{v} = \|\bar{v}\| \langle \cos\theta_1, \sin\theta_1 \rangle$

$= \|\bar{v}\| \langle \frac{20}{\sqrt{976}}, \frac{24}{\sqrt{976}} \rangle$

$= b \langle \quad \rangle$

$\boxed{a = \|\bar{u}\| \quad b = \|\bar{v}\|}$

We want $\bar{u}+\bar{v}=-\bar{w}$

$$\left\langle \frac{-10a}{\sqrt{676}}, \frac{24a}{\sqrt{676}} \right\rangle + \left\langle \frac{20b}{\sqrt{976}}, \frac{24b}{\sqrt{976}} \right\rangle = \langle 0, 5100 \rangle$$

$$\Longrightarrow \frac{-10a}{\sqrt{676}} + \frac{20b}{\sqrt{976}} = 0 \longleftarrow \text{solve for } b$$

$$\frac{24a}{\sqrt{676}} + \frac{24b}{\sqrt{976}} = 5100$$

$$\frac{20b}{\sqrt{976}} = \frac{10a}{\sqrt{676}}$$

$$b = \frac{10a}{\sqrt{676}} \cdot \frac{\sqrt{976}}{20} = \frac{a}{2} \cdot \sqrt{\frac{976}{676}} = \frac{\sqrt{244}}{26} a$$

$$\frac{244}{\cancel{488}} \quad \cancel{976} \quad \cancel{676} \quad \cancel{338} \quad 169 = \frac{244}{169} \rightsquigarrow \sqrt{\frac{244}{169}} = \frac{\sqrt{244}}{13}$$

Premature Simplification

$$\cancel{\frac{24}{\sqrt{676}} \cdot \frac{\sqrt{244}}{26} a} +$$

Sub for b, not a, dummy.

$$\frac{24a}{\sqrt{676}} + \frac{24}{\sqrt{676}} \cdot \frac{\sqrt{244}}{26} a = 5100$$

Without wasting time on premature simplification:

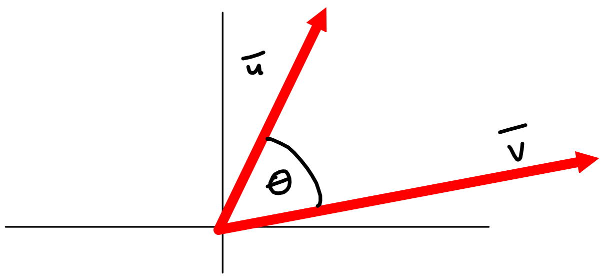
$$b = \frac{10a}{20} \cdot \sqrt{\frac{976}{676}} = \left(\frac{1}{2}\sqrt{\frac{976}{676}}\right) a$$

$$\frac{24a}{\sqrt{676}} + \frac{\overset{12}{\cancel{24}}}{\cancel{\sqrt{976}}} \left(\frac{1}{\cancel{2}} \cdot \sqrt{\frac{\cancel{976}}{676}}\right) a = \frac{24}{\sqrt{676}} \cdot a + \frac{12}{\sqrt{676}} a =$$

$$= \frac{36}{\sqrt{676}} a \overset{\text{SET}}{=} 5100 \longrightarrow$$

$$a = \frac{5100\sqrt{676}}{36} \approx \boxed{3683.33333333 \text{ lb} \approx a = \|\bar{u}\|}$$

$$b = \frac{1}{2} \frac{\sqrt{976}}{\sqrt{676}} a \approx \frac{1}{2} \frac{\sqrt{976}}{\sqrt{676}} (3683.33333333) \approx \boxed{2212.90407484 \text{ lb} \approx b = \|\bar{v}\|}$$



Recall:
We used Law of Cosines to show that

$$\cos\theta = \frac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|}$$

Dot product for cosine of the angle between 2 vectors. Since the angle is never greater than 189 degrees, this means that cosine is 1-to-1 and arccosine gives the angle, without needing to interpret.

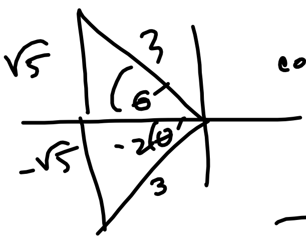
In general, arccosine, arcsine, and arctangent will get you to the reference angle (or its negative), but you need to interpret the calculator output to adjust to the correct quadrant.

$\cos\theta = -\frac{2}{3}$ & $\sin\theta < 0$

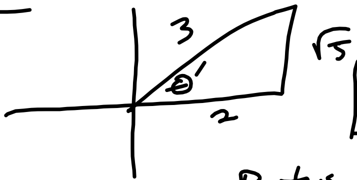
is in quadrant III

$\arccos(x)$ has range $[0, \pi]$

Quadrant III has $\theta \in [\pi, \frac{3\pi}{2}]$



$\cos\theta = -\frac{2}{3}$ picture



$\boxed{\theta' = \arccos\left(\frac{2}{3}\right)}$

By this, we have

$\boxed{\theta = \pi - \theta' \text{ or } \pi + \theta'}$

I wanted to do projection, today.

We'll do 'em next time.