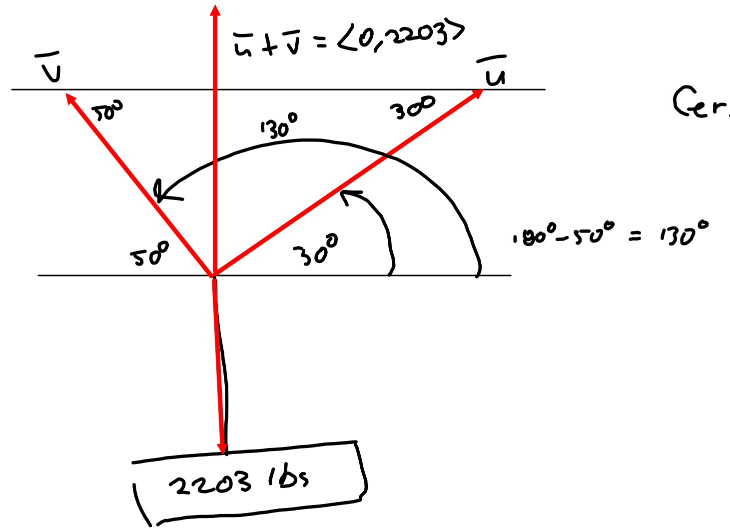
MIDTERM:

RM 107 Horizon Hall 8 am - 6 pm Monday 3/31 or Tuesday 4/1

Bring scientific calculator,
pen or pencil,
1-page cheat sheet (2 sides is ok)
Photo ID

A weight of 2203 lbs is suspended from 2 hooks as shown in the picture.

What's the tension in each cable?



Cerberus

Let $x = \|\bar{u}\|$ = tension in cable on right, in lbs.

$y = \|\bar{v}\| =$ " " " " left., " ".

Then $\bar{u}+\bar{v} = \langle 0, 2203\rangle$

$\bar{u} = \|\bar{u}\|\langle \cos(30°), \sin(30°)\rangle = x\langle \frac{\sqrt{3}}{2}, \frac{1}{2}\rangle$

$= \langle \frac{\sqrt{3}}{2}, \frac{1}{2}\rangle x$

$= \langle \frac{\sqrt{3}}{2}x, \frac{1}{2}x\rangle$

$\bar{v} = \cdot \cdots = y\langle \cos 130°, \sin 130°\rangle$

$= \langle ay, by\rangle$, where $a = \cos 130°$, $b = \sin 130°$

So $\bar{u}+\bar{v} = \langle \frac{\sqrt{3}}{2}x, \frac{1}{2}x\rangle + \langle ay, by\rangle = \langle 0, 2203\rangle$

$\frac{\sqrt{3}}{2}x + ay = 0 \longrightarrow \frac{\sqrt{3}}{2}x = -ay \longrightarrow \boxed{x = \frac{-2a}{\sqrt{3}}y}$

$\frac{1}{2}x + by = 2203 \longrightarrow \frac{1}{2}\left(-\frac{2a}{\sqrt{3}}y\right) + by =$

$= \left(-\frac{a}{\sqrt{3}} + b\right)y = 2203 \longrightarrow$

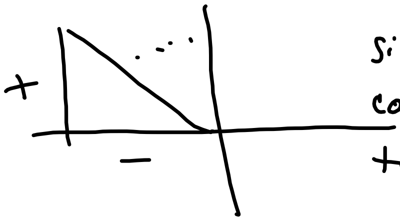
$y = \frac{2203}{-\frac{a}{\sqrt{3}} + b} = \frac{2203}{-\frac{\cos 130°}{\sqrt{3}} + \sin 130°} \approx \boxed{1937.28568718 \text{ lbs} \approx y}$

$\approx \boxed{1937 \text{ lbs} \approx \|\bar{u}\|}$

$x = -\frac{2a}{\sqrt{3}}y = -\frac{2\cos(130°)}{\sqrt{3}}y \approx 1437.9061292 \approx \boxed{1438 \text{ lbs} \approx \|\bar{v}\|}$

$\approx \frac{-2\cos(130°)}{\sqrt{3}}(1437.9061292) \approx 1937.28568718 \approx \boxed{1937 \text{ lbs} \approx \|\bar{u}\|}$

$90^\circ < \frac{u}{2} < 135^\circ$



sine +

cosine −

tangent −

Midterm: Old Midterm is a good thing to study **Link**

Find all $x \in [0, 2\pi)$ such that the following equation is solved.

$2\sin(4x) + 2\sin(2x) = 0$

$\Rightarrow 2(2\sin(2x)\cos(2x)) + 2\sin(2x) =$

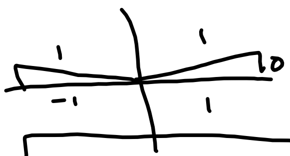
$= 4\sin(2x)\cos(2x) + 2\sin(2x) = 0 \longrightarrow$

$2\sin(2x)\left[2\cos(2x) + 1\right] = 0$

Want all $x \in [0, 2\pi) \longrightarrow$ Find all $2x \in [0, 4\pi)$

$2\sin(2x) = 0$

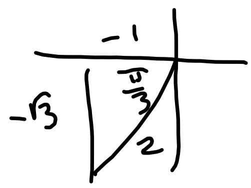
$\sin(2x) = 0$

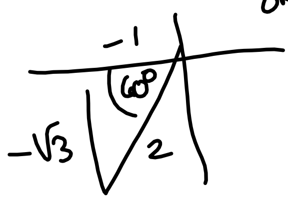


$\boxed{2x = 0, \pi, 2\pi, 3\pi}$

$\longrightarrow x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

OR

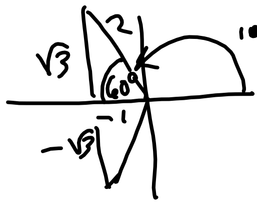




$2\cos(2x) + 1 = 0$

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

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



$180^\circ - 60^\circ = 120^\circ\left(\frac{\pi}{180^\circ}\right) = \frac{2\pi}{3}$

$60^\circ = \frac{\pi}{3}$

$30^\circ = \frac{\pi}{6}$

$45^\circ = \frac{\pi}{4}$

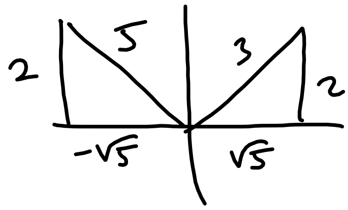
$180^\circ = \pi$

$2x = \frac{2\pi}{3}$

$2x = \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}$

$\longrightarrow \boxed{x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}}$

$\sin\theta = \frac{2}{3}$



$3^2 - 2^2 = 9 - 4 = 5 \rightsquigarrow \sqrt{5}$

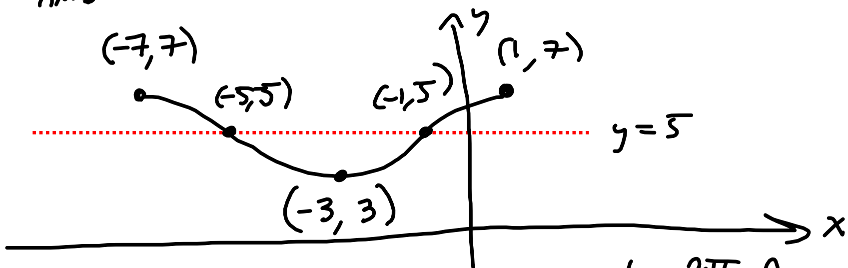
up 5!

Left 7!

$f(x) = 2\cos\left(\frac{\pi}{4}x + \frac{7}{4}\right) + 5$

Amplitude

$\frac{\pi}{4}x + \frac{7}{4} = \frac{\pi}{4}(x+7)$



$bx = 2\pi$

$\frac{\pi}{4}x = 2\pi$ $\longrightarrow$

$x = \frac{2\pi}{\frac{\pi}{4}} = 2\pi \cdot \frac{4}{\pi} = 8$

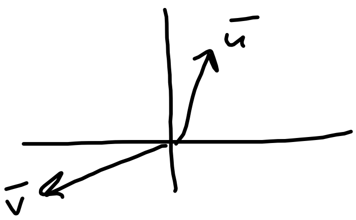
Period = $\frac{2\pi}{b}$ for $\cos(bx)$ & $\cos(bx + c)$

There will be a Law of Sines 3.1

Law of Cosines 3.2

Vectors 3.3

Dot Product 3.4



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

$\bar{v} = \langle -6,-2 \rangle$

$\|\bar{u}\| = \sqrt{1^2+5^2} = \boxed{\sqrt{26} = \|\bar{u}\|}$

$\bar{u}+\bar{v} = \langle -5,3 \rangle$

$\boxed{\|\bar{u}+\bar{v}\| = \sqrt{5^2+3^2}} = \sqrt{25+9} = \boxed{\sqrt{34} = \|\bar{u}+\bar{v}\|}$

$\|\bar{v}\| = \sqrt{6^2+2^2} = \sqrt{40} = \boxed{2\sqrt{10} = \|\bar{v}\|}$

Angle Between $\bar{u}$ & $\bar{v}$

$$\cos\theta = \frac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|} = \frac{\langle 1,5\rangle \circ \langle -6,-2\rangle}{\sqrt{26}\,(2\sqrt{10})} = \frac{-6-10}{2\sqrt{260}}$$

$$= \frac{-16}{2(2\sqrt{65})} = \frac{-16}{4\sqrt{65}} = \frac{-8}{\sqrt{65}} = \cos\theta$$

$$\longrightarrow \boxed{\theta = \arccos\left(-\frac{8}{\sqrt{65}}\right)}$$

2 | 260
2 | 130
5 | 65
13

To nearest 4 digits

$172.874983651^\circ \approx \boxed{172.8750^\circ}$