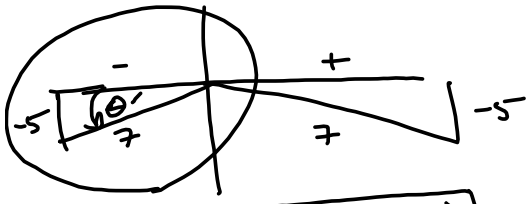
$\sin\theta = -\frac{5}{7}$ and $\tan\theta > 0$ and $\theta \in [0, 2\pi)$



$\theta' = \arcsin\left(\frac{5}{7}\right)$ & then

$\theta = \pi + \theta'$ Exact

All solns in $[0, 2\pi)$

$\pi + \theta', 2\pi - \theta'$

All solns:

$\pi + \theta' + 2\pi n, 2\pi - \theta' + 2\pi n \quad n \in \mathbb{Z}$ FINE

$(2n+1)\pi + \theta', 2\pi(n+1) + \theta', n \in \mathbb{Z}$ FANCY

$2\pi n + \pi = \pi(2n+1)$

$2\pi n + 2\pi = 2\pi(n+1)$

Show all work. **Circle Final Answers.** Scratch work goes with the problem, and not on a separate sheet. **Do your own work**. Leave at least ½-inch margins around each sheet. If you're taking the test in Horizon Hall, this has already been done for you.

Supporting work comes *before* the final answer.

Work as few or as many bonus as you like. Bonus problems tend to be higher difficulty and more time-consuming. If you work all of them, you're likely to run out of time.

If you skip a problem, to come back to, later, start the next problem on a fresh sheet of paper.

Deductions taken off the top: (Bad things).
-10%: Work is cramped and there's no room for comments or your work is hard to follow.
-10%: Problems are submitted in the wrong order.

Partial credit for each question:
A typical 5-pointer is broken down as follows:
2 pts – Setup
2 pts – Supporting work
1 pt - Final Answer

Leave plenty of space. If it's too cramped to efficiently award partial credit, there will be no partial credit. If you get the answer right, but I can't understand what you did, you will get ½-credit, at most. I need to see the support. I need to see all the scratch work for each problem WITH that problem, not on a separate sheet.

Turn in your test sheets, your work, and your cheat sheet. Test sheets on top. Your work, in order, next, and Cheat Sheet at the bottom of the pile.

Draw Pictures! Fare well!

Test-taking strategy:

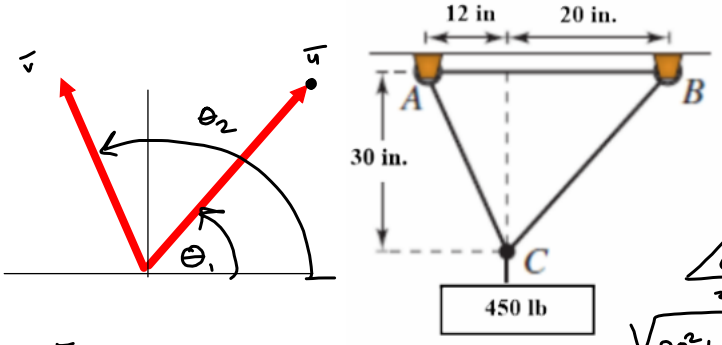
Don't spend more than 2 minutes on any problem on your first pass through the test.

If you don't finish a problem on the first try, start a fresh sheet of paper and start the next problem.

Write on only 1 side of each page.

Let $x = \|\bar{u}\|$ = tension in 1st cable (pounds) } Lexicon.

$y = \|\bar{v}\|$ = " " 2nd " "



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

$= x \left\langle \frac{20}{10\sqrt{13}}, \frac{30}{10\sqrt{13}} \right\rangle = x \left\langle \frac{2}{\sqrt{13}}, \frac{3}{\sqrt{13}} \right\rangle$

$= \left\langle \frac{2}{\sqrt{13}}x, \frac{3}{\sqrt{13}}x \right\rangle = \bar{u}$

where $x = \|\bar{u}\|$.

$\sqrt{20^2+30^2} = \sqrt{400+900} = \sqrt{1300}$

$= 10\sqrt{13}$

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

$= y \left\langle \frac{-12}{4\sqrt{29}}, \frac{30}{6\sqrt{29}} \right\rangle$

$= y \left\langle \frac{-2}{\sqrt{29}}, \frac{5}{\sqrt{29}} \right\rangle$

$= \left\langle -\frac{2}{\sqrt{29}}y, \frac{5}{\sqrt{29}}y \right\rangle = \bar{v}$

where $y = \|\bar{v}\|$

$\sqrt{12^2+30^2} = \sqrt{144+900}$

$= \sqrt{1044}$

2 | 1044
2 | 522
3 | 261
3 | 87
29

$6\sqrt{29}$

$\bar{u} + \bar{v} = \langle 0, 450 \rangle$

$\left\langle \frac{2}{\sqrt{13}}x, \frac{3}{\sqrt{13}}x \right\rangle + \left\langle -\frac{2}{\sqrt{29}}y, \frac{5}{\sqrt{29}}y \right\rangle = \langle 0, 450 \rangle$

$\frac{2}{\sqrt{13}}x - \frac{2}{\sqrt{29}}y = 0 \longrightarrow \frac{2}{\sqrt{13}}x = \frac{2}{\sqrt{29}}y \longrightarrow x = \frac{\sqrt{13}}{\sqrt{29}}y$

$= \sqrt{\frac{13}{29}}\,y$

$\frac{3}{\sqrt{13}}x + \frac{5}{\sqrt{29}}y = 450$

$\longrightarrow \left(\frac{3}{\sqrt{13}}\right)\left(\frac{\sqrt{13}}{\sqrt{29}}\right)y + \frac{5}{\sqrt{29}}y = 450$

$\longrightarrow \frac{3}{\sqrt{29}}y + \frac{5}{\sqrt{29}}y = \frac{8}{\sqrt{29}}y = 450 \longrightarrow$

$y = \frac{450\sqrt{29}}{8}$

Need to round to nearest pound!

$\longrightarrow x = \frac{\sqrt{13}}{\sqrt{29}}y = \frac{\sqrt{13}}{\sqrt{29}} \cdot \frac{450\sqrt{29}}{8} = \frac{225\sqrt{13}}{4} = x = \|\bar{u}\|$

29

$\bar{u} + \bar{v} = \langle 0, 450 \rangle$

$\left\langle \frac{2}{\sqrt{13}}x, \frac{3}{\sqrt{13}}x \right\rangle + \left\langle -\frac{2}{\sqrt{29}}y, \frac{5}{\sqrt{29}}y \right\rangle = \langle 0, 450 \rangle$

$\frac{2}{\sqrt{13}}x - \frac{2}{\sqrt{29}}y = 0 \longrightarrow \frac{2}{\sqrt{13}}x = \frac{2}{\sqrt{29}}y \longrightarrow x = \frac{\sqrt{13}}{\sqrt{29}}y$

$= \sqrt{\frac{13}{29}}\, y$

$\frac{3}{\sqrt{13}}x + \frac{5}{\sqrt{29}}y = 450$

$\longrightarrow \left(\frac{3}{\sqrt{13}}\right)\left(\frac{\sqrt{13}}{\sqrt{29}}\right)y + \frac{5}{\sqrt{29}}y = 450$

$\longrightarrow \frac{3}{\sqrt{29}}y + \frac{5}{\sqrt{29}}y = \frac{8}{\sqrt{29}}y = 450 \longrightarrow$

$y = \frac{450\sqrt{29}}{8}$

Need to round to nearest pound!

$\longrightarrow x = \frac{\sqrt{13}}{\sqrt{29}}y = \frac{\sqrt{13}}{\sqrt{29}} \cdot \frac{450\sqrt{29}}{8} = \frac{225\sqrt{13}}{4} = x = 202$

$\|\bar{u}\|$

6. Let $z_1 = 81\left(\cos\left(\frac{4\pi}{9}\right)+i\sin\left(\frac{4\pi}{9}\right)\right)$ and $z_2 = 2\left(\cos\left(\frac{\pi}{7}\right)+i\sin\left(\frac{\pi}{7}\right)\right)$.

a. (5 pts) Compute the quotient $\frac{z_1}{z_2}$. Give an exact answer.

b. (5 pts) Find the 4th roots of z_1.

c. (5 pts) Convert z_1 to rectangular form. Round to 3 decimal places.

$\frac{4\pi}{9} - \frac{\pi}{7} = \frac{(28-9)\pi}{63}$

(a) $\frac{z_1}{z_2} = \frac{81}{2}\left(\cos\left(\frac{19\pi}{63}\right)+i\sin\left(\frac{19\pi}{63}\right)\right)$ $= \frac{19\pi}{63}$

$z_1 = 81\left(\cos\frac{4\pi}{9}+i\sin\frac{4\pi}{9}\right)$

4th roots: $\sqrt[4]{81} = 3$

$\frac{\frac{4\pi}{9}}{4} = \frac{\pi}{9}$ = 1st angle $k=0$

increment is $\frac{2\pi}{4} = \frac{\pi}{2}$

$\frac{\pi}{9} + \frac{\pi}{2} = \frac{2\pi + 9\pi}{18} = \frac{11\pi}{18}$

$\sqrt[4]{z} = 3\left(\cos\left(\frac{\pi}{9}\right)+i\sin\left(\frac{\pi}{9}\right)\right)$,

$3\left(\cos\left(\frac{11\pi}{18}\right)+i\sin\left(\frac{11\pi}{18}\right)\right)$

$3\left(\cos\left(\frac{10\pi}{9}\right)+i\sin\left(\frac{10\pi}{9}\right)\right)$

$3\left(\cos\left(\frac{29\pi}{18}\right)+i\sin\left(\frac{29\pi}{18}\right)\right)$

$\frac{20\pi}{18}$

$\frac{29\pi}{18}$

$\frac{38\pi}{18} = \frac{36\pi}{18} + \frac{2\pi}{18} = 2\pi + \frac{\pi}{9}$

Horizon Hall Rm 107

Monday, May 11th

Any time between 10 am and 6 pm.

Want $\frac{mi}{hr}$. Given $r = \frac{30}{2}$ inches $= 15$ inches

and $\frac{100 \text{ rev}}{\text{min}}$

$$\left(\frac{100 \text{ rev}}{\text{min}}\right)\left(\frac{2\pi}{1 \text{ rev}}\right)(15 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right)\left(\frac{60 \frac{mi}{hr}}{88 \frac{ft}{s}}\right)$$

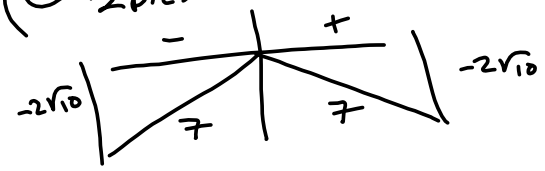
$\left(\frac{\theta}{\text{min}}\right)$ (r)

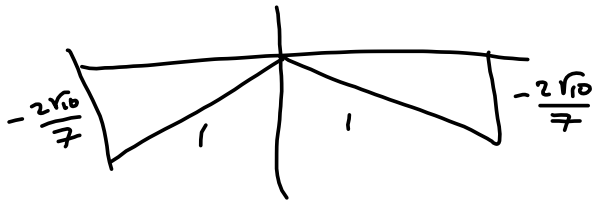
$$\left(\frac{100 \text{ rev}}{\text{min}}\right)\left(\frac{2\pi}{1 \text{ rev}}\right)(15 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)\left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right)\left(\frac{60 \text{ min}}{1 \text{ hr}}\right)$$

$$= \frac{\overset{25}{\cancel{100}}(2\pi)(\overset{5}{\cancel{15}})(60)}{\cancel{(12)}(5280)} = \frac{25 \cdot 2 \cdot 5 \cdot 6}{\cancel{528}\ 264} = \frac{\cancel{375}\ 125}{\cancel{750}\pi\ 264\ \cancel{132}\ 44} = \boxed{\frac{125\pi}{44} \frac{mi}{hr}}$$

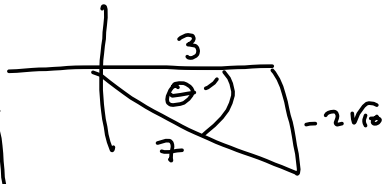
$\sin\theta = -\frac{2\sqrt{10}}{7}$

(a) 2 pics:





(b) $\tan\theta < 0 \Rightarrow$



$\theta \in$ QIV

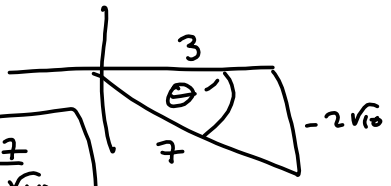
$7^2 - (2\sqrt{10})^2 = 49 - 40 = 9 = 3^2 = b^2$

(c) θ' = reference angle. $= \arccos\left(\frac{3}{7}\right) = \arcsin\left(\frac{2\sqrt{10}}{7}\right)$

$= \arctan\left(\frac{2\sqrt{10}}{3}\right)$

Then $\theta = 2\pi - \theta'$

(d) Round to 3 places



(e)

$\sin\theta = -\frac{2\sqrt{10}}{7}$	$\csc\theta = -\frac{7}{2\sqrt{10}}$
$\cos\theta = \frac{3}{7}$	$\sec\theta = \frac{7}{3}$
$\tan\theta = -\frac{2\sqrt{10}}{7}$	$\cot\theta = -\frac{7}{2\sqrt{10}}$