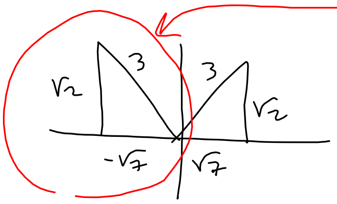
Find $\sin(2u)$, $\cos(2u)$ & $\tan(2u)$, given

$\sin(u) = \frac{\sqrt{2}}{3}$ and $\cos(u) < 0$

Like #9




$9-2=7$

$$\sin(2u) = 2\sin u \cos u = 2\left(\frac{\sqrt{2}}{3}\right)\left(-\frac{\sqrt{7}}{3}\right) = \boxed{-\frac{2\sqrt{14}}{9} = \sin(2u)}$$

$$\cos(2u) = \cos^2 u - \sin^2 u = \left(-\frac{\sqrt{7}}{3}\right)^2 - \left(\frac{\sqrt{2}}{3}\right)^2 = \frac{7}{9} - \frac{2}{9} = \boxed{\frac{5}{9} = \cos(2u)}$$

$$\Rightarrow \tan(2u) = \frac{\sin(2u)}{\cos(2u)} = \frac{-2\sqrt{14}}{9} \cdot \frac{9}{5} = \boxed{-\frac{2\sqrt{14}}{5} = \tan(2u)}$$

Like #7

$\sin\left(-\frac{5\pi}{12}\right)$

a) $-\frac{5\pi}{12} = \frac{\pi}{12} - \frac{6\pi}{12} = \frac{2\pi}{12} - \frac{7\pi}{12} = \frac{3\pi}{12} - \frac{8\pi}{12}$

$-\frac{2\pi}{3} + \frac{\pi}{4}$

I don't memorize the ±, here

$\Rightarrow \sin\left(-\frac{5\pi}{12}\right) = \sin\left(\frac{\pi}{4} - \frac{2\pi}{3}\right) = \sin\left(\frac{\pi}{4}\right)\cos\left(-\frac{2\pi}{3}\right) + \sin\left(-\frac{2\pi}{3}\right)\cos\left(\frac{\pi}{4}\right)$

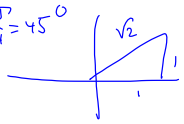
cosine is even   sine is odd

$= \sin\left(\frac{\pi}{4}\right)\cos\left(\frac{2\pi}{3}\right) - \sin\left(\frac{2\pi}{3}\right)\left(\cos\left(\frac{\pi}{4}\right)\right)$

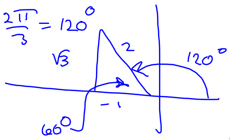
sine is odd

Instead, I use $\sin u \cos v + \sin v \cos u$ & manage odd/even when $v < 0$.

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




$\frac{2\pi}{3} = 120^\circ$

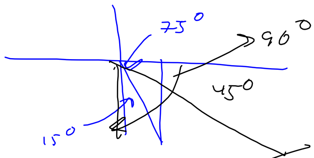



cont'd... $= \left(\frac{1}{\sqrt{2}}\right)\left(-\frac{1}{2}\right) - \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right) = \boxed{\frac{-1-\sqrt{3}}{2\sqrt{2}} = \sin\left(-\frac{5\pi}{12}\right)}$

b) $-\frac{5\pi}{12} = \frac{1}{2}\left(-\frac{5\pi}{6}\right) = \frac{1}{2}u = \frac{u}{2}$

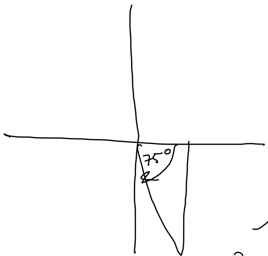
$\left(-\frac{5\pi}{12}\right)\left(\frac{180^\circ}{\pi}\right) = -5(15)^\circ = -75^\circ$

$\frac{180}{12} = \frac{30}{2} = 15$




So $270^\circ < \frac{u}{2} < 315^\circ$

$\Rightarrow$ ~~$540^\circ < u < 630^\circ$~~




~~$540 - 360 = 180$~~

THIS: I'm measuring positive angles. Should do the negative.

$-90^\circ < -75^\circ < -45^\circ$

$-180 < -150^\circ = u < -90^\circ \Rightarrow$ QIII $\Rightarrow$

$-75^\circ = \frac{u}{2}$

$-90^\circ < \frac{u}{2} < -45^\circ$

$-180^\circ < u < -90^\circ$

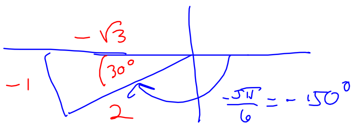
Don't need.

Just find Quadrant $-\frac{5\pi}{12}$ lives in.

$\sin\left(-\frac{5\pi}{12}\right) = \sqrt{\frac{1-\cos\left(-\frac{5\pi}{6}\right)}{2}}$

$\left( \frac{u}{2} = -\frac{5\pi}{12} \right.$

$u = -\frac{5\pi}{6} \cdot \frac{180^\circ}{\pi} = -150^\circ$




$\left.\right)$


$u \in$ QIII

$\cos(u) < 0$ (left half).

So continuing:

$\sin\left(-\frac{5\pi}{12}\right) = \sin(-75^\circ)$ is negative

$= -\sqrt{\frac{1-\left(-\frac{\sqrt{3}}{2}\right)}{2}}$

$= -\sqrt{\frac{2+\sqrt{3}}{4}} = \boxed{-\frac{\sqrt{2+\sqrt{3}}}{2} = \sin\left(-\frac{5\pi}{12}\right)}$

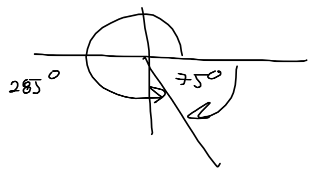
7b half-angle identity

$$\sin\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1-\cos(u)}{2}}$$

Decided by where $\frac{u}{2}$ lives.

$$\sin\left(\frac{19\pi}{12}\right) = \sin\left(\frac{1}{2}\left(\frac{19\pi}{6}\right)\right)$$

$$\frac{19\pi}{12}\cdot\frac{180^\circ}{\pi} = (19)(15)^\circ = 285^\circ$$




So $\frac{u}{2} = \frac{19\pi}{12} \in Q\,\overline{IV}$

$$\Rightarrow \sin\left(\frac{u}{2}\right) = -\sqrt{\phantom{x}}$$

**B1**

$d = 10$ cm , $s = 500$ m $\qquad s = r\theta$

How many revs?

$d = 10$ cm $\Rightarrow \boxed{r = 5\text{ cm}}$

$(500\text{ m})\left(\frac{100\text{ cm}}{\text{m}}\right) = \boxed{50000\text{ cm} = s}$

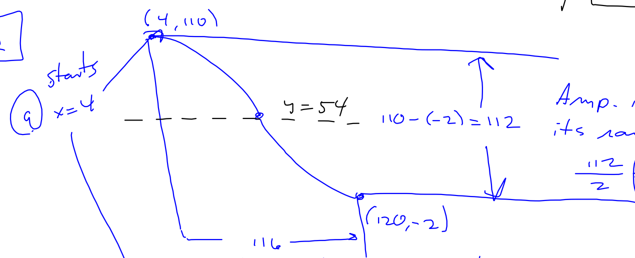
$s = r\theta$

$\Rightarrow 50{,}000 = 5\theta$

$\Rightarrow \frac{50000}{5} = \theta = 10{,}000$ radians

$= (10000\text{ radians})\left(\frac{1\text{ revolution}}{2\pi\text{ radians}}\right) = \boxed{\frac{5000}{\pi}\text{ revs.}}$

**B2**




$110-(-2) = 112$

Amp. is half its range: $\frac{112}{2} = \boxed{56 = a}$

$116 = \frac{1}{2}T$ = what goes under $\pi$.

See? $T = 116 \cdot 2 = 232$

want $bx = 2\pi$ when $x = 232$.

$232b = 2\pi$

$b = \frac{2\pi}{232} = \frac{\pi}{116}$. See?

$\cos\left(\frac{\pi}{116}(x-4)\right)$

$56\cos\left(\frac{\pi}{116}(x-4)\right)$

Now. Midline: Average of High & low

$\frac{110+(-2)}{2} = \frac{108}{2} = 54 = y =$ midline

$\Rightarrow \boxed{f(x) = 56\cos\left(\frac{\pi}{116}(x-4)\right) + 54}$

**B3** $A = \frac{1}{2}r^2\theta$

$r = 60$ cm

$\theta = 330^\circ = (330^\circ)\left(\frac{\pi}{180^\circ}\right) = \frac{33\pi}{18} = \frac{11\pi}{6}$

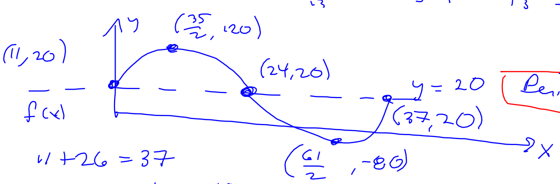
$\Rightarrow A = \frac{1}{2}(60)^2\left(\frac{11\pi}{6}\right) = \frac{1}{\cancel{2}}\frac{(60)\cancel{(60)}^{5}(\pi)}{\cancel{6}} = 300\pi$ cm$^2$

cm$^2$

**B4** $f(x) = 100\sin\left(\frac{\pi}{13}x + \frac{11\pi}{13}\right) + 20$

$\frac{\pi}{13}x + \frac{11\pi}{13} = \frac{\pi}{13}\left(x + \frac{\frac{11\pi}{13}}{\frac{\pi}{13}}\right) = \frac{\pi}{13}\left(x + \frac{11\pi}{13}\cdot\frac{13}{\pi}\right) = \frac{\pi}{13}(x+11)$

Start @ $x = -11$




Period is twice the 13. $26 = T$ cheat

$11 + 26 = 37$

$\frac{37+11}{2} = \frac{48}{2} = 24$

$\frac{11+24}{2} = \frac{35}{2}$

$\frac{24+37}{2} = \frac{61}{2}$

Amplitude is 100

$20 + 100 = 120$

$20 - 100 = -80$

$\frac{\pi}{13}x = 2\pi$

$x = \frac{26\pi}{\pi} = 26$, is how to reason it out. Want to know when $\frac{\pi}{13}x$ reaches $2\pi$ to obtain period.