Bicycle Question

$s = r\theta$

Arclength $= r\theta$

Pedal @ 2 rps $\quad 2 \frac{\text{rotations}}{\text{sec}}$

Front sprocket 6"

Rear sprocket 2"

Radius of rear wheel 16"

$\frac{\text{ft}}{\text{sec}}$ & $\frac{\text{mi}}{\text{hr}}$

$$\left(2\frac{\text{revs front}}{\text{sec}}\right)\left(\frac{6 \text{ revs rear}}{2 \text{ revs front}}\right)\left(\frac{2\pi \text{ radians}}{1 \text{ rev rear}}\right)\underbrace{(16\text{ in})}_{r}\left(\frac{1\text{ ft}}{12\text{ in}}\right)$$

$\underbrace{\qquad\qquad}_{\frac{\theta}{\text{sec}}}$

$\frac{\text{inches}}{\text{sec}}$ on the ground

$\frac{\text{miles}}{\text{hr}}$:

$$\frac{88\text{ ft}}{\text{sec}} = \frac{60\text{ mi}}{\text{hr}} \Rightarrow$$

$$\frac{\frac{60\text{ mi}}{\text{hr}}}{\frac{88\text{ ft}}{\text{sec}}} = 1$$

$$(\text{Previous ans})\left(\frac{60\frac{\text{mi}}{\text{hr}}}{\frac{88\text{ ft}}{\text{sec}}}\right) \text{ is miles/hr}$$

$$\left(\text{Previous Ans in } \frac{\text{ft}}{\text{sec}}\right)\left(\frac{1\text{ mi}}{5280\text{ ft}}\right)\left(\frac{60\text{ sec}}{1\text{ min}}\right)\left(\frac{60\text{ min}}{1\text{ hr}}\right)$$

also converts it to $\frac{\text{mi}}{\text{hr}}$

mph = miles per hour

$= \frac{\text{miles}}{\text{hr}}$

Find all solutions x of the equation $\sin(3x) = \frac{1}{2}$ in

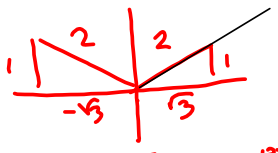
... $[0, 2\pi]$

... All of 'em!

Want all $x \in [0, 2\pi]$

means want all $3x \in [0, 6\pi]$

$\sin(3x) = \frac{1}{2}$



$\frac{\pi}{6} + 2\pi = \frac{13\pi}{6} = 2\pi + \frac{\pi}{6}$

$\frac{5\pi}{6} + 2\pi = \frac{17\pi}{6} = 2\pi + \frac{5\pi}{6}$

$3x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}, \frac{25\pi}{6}, \frac{29\pi}{6}$

$\frac{25\pi}{6} + \frac{12\pi}{6} = \frac{37\pi}{6}$

$\frac{25\pi}{6} = 4\pi + \frac{\pi}{6}$

$\frac{29\pi}{6} = 4\pi + \frac{5\pi}{6}$

$\frac{37\pi}{6} = 6\pi + \frac{\pi}{6}$ TOO BIG

$x = \frac{\pi}{18}, \frac{5\pi}{18}, \frac{13\pi}{18}, \frac{17\pi}{18}, \frac{25\pi}{18}, \frac{29\pi}{18}$

$x \in \left\{ \frac{\pi}{18}, \frac{5\pi}{18}, \frac{13\pi}{18}, \frac{17\pi}{18}, \frac{25\pi}{18}, \frac{29\pi}{18} \right\}$ is solution-set answer.

For All solutions, just do this

$3x = \frac{\pi}{6}^*, \frac{5\pi}{6}, \frac{13\pi}{6}^*, \frac{17\pi}{6}, \frac{25\pi}{6}^*, \frac{29\pi}{6}$

For ALL of them, just add $2n\pi$ to these

$\frac{\pi}{6} + 2n\pi, \frac{5\pi}{6} + 2n\pi, \ldots, \frac{29\pi}{6} + 2n\pi$

$\Rightarrow x = \frac{\pi}{18} + \frac{2n\pi}{3}, \frac{5\pi}{18} + \frac{2n\pi}{18}$ if we're clever.

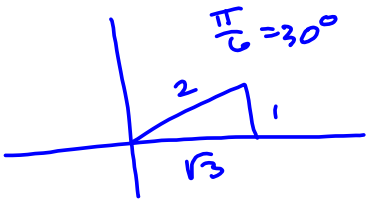
OR just

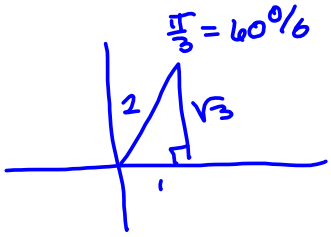
$x \in \left\{ \frac{\pi}{6} + \frac{2n\pi}{3}, \frac{5\pi}{6} + \frac{2n\pi}{3} \;\middle|\; n \in \mathbb{Z} \right\}$

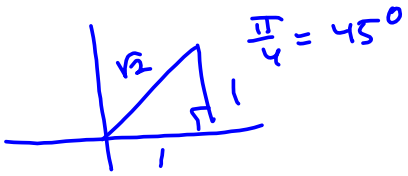
Integers: $\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\} = \mathbb{Z}$

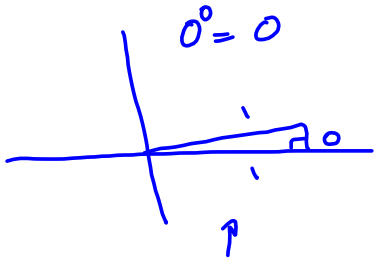
Rational #s: $\left\{ \frac{p}{q} \;\middle|\; p, q \in \mathbb{Z}, q \neq 0 \right\} = \mathbb{Q}$

Real #s: $\mathbb{R} = (-\infty, \infty)$





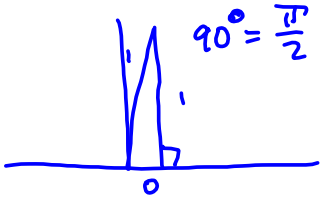




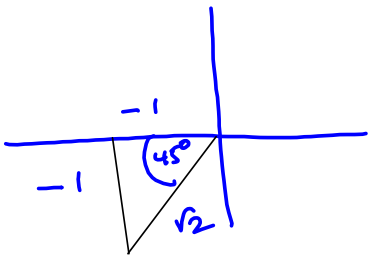
$\sin(0) = \frac{0}{1} = 0$

$\cos(0) = \frac{1}{1} = 1$

$\tan(0) = \frac{0}{1} = 0$



$\sin(225^\circ) = \frac{0}{+} = -\frac{1}{\sqrt{2}}$



$\tan(\beta) = \frac{13}{15}$ β From WP#0.

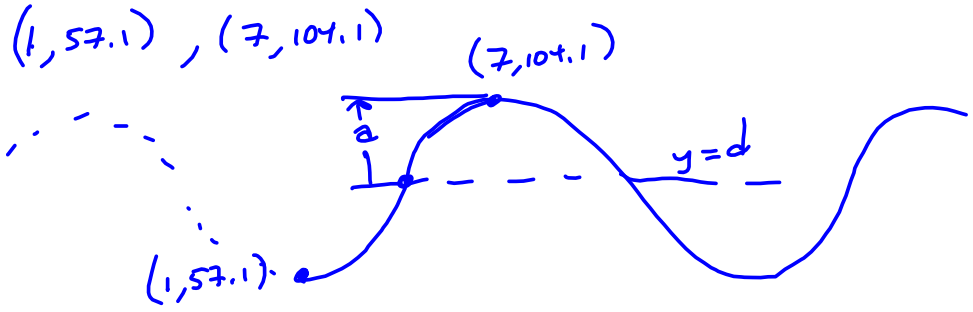
$\sqrt{13^2+15^2} = \sqrt{169+225} = \sqrt{394}$

$2 \mid 394$
197

$\sin(\beta) = \frac{13}{\sqrt{394}}$ $\csc(\beta) = \frac{\sqrt{394}}{13}$

$\cos(\beta) = \frac{15}{\sqrt{394}}$ $\sec(\beta) = \frac{\sqrt{394}}{15}$

$\tan(\beta) = \frac{13}{15}$ $\cot(\beta) = \frac{15}{13}$



Period = 12 months.

want $bx = 2\pi$ when $x = 12$ $\Rightarrow$ $b \cdot 12 = 2\pi$, $b = \frac{2\pi}{12} = \frac{\pi}{6}$

$a\cos(b(x-c)) + d$

$= a\cos\left(\frac{\pi}{6}(x-c)\right) + d$

high Point : $x = 7$

$a\cos\left(\frac{\pi}{6}(x-7)\right) + d$

a = Amplitude $= \frac{104.1 - 57.1}{2}$

d = midline $= \frac{104.1 + 57.1}{2}$