Questions? 1.1 #19

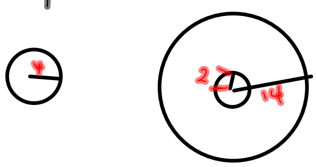
$1 \frac{\text{revolution}}{1\,\text{sec}}$

(a) Find speed of bike in $\frac{ft}{sec}$ & $\frac{\text{miles}}{hr}$

(b) Write a function for distance as function of revolutions of the pedal

(c) .... as function of time t

(d) Classify....



r = 4
rps = 1

One revolution of pedal is how much chain?

$2\pi \cdot 4 = 8\pi$ inches of chain per second.

⇒ 2 revolutions of the rear sprocket per second.

⇒ 2 revolutions of the tire per second.

(a) $\left(\frac{2\text{ revs}}{sec}\right)\left(\frac{2\pi \cdot 14\text{ inches}}{1\text{ rev}}\right)\left(\frac{1\text{ ft}}{12\text{ inches}}\right) = \boxed{\frac{14}{3}\pi \frac{ft}{sec}}$

$\left(\frac{14}{3}\pi\right)\frac{ft}{s} \cdot \frac{1\text{ mi}}{5280\text{ ft}} = \frac{14\pi}{3 \cdot 5280}\frac{mi}{s} \cdot \frac{3600\,s}{1\,hr} =$

$= \frac{14 \cdot 3600\pi}{3 \cdot 5280}\frac{mi}{hr} = 3.\overline{18}\pi \frac{mi}{hr} \approx 10$ mph

I think $88\,ft/s = 60\,\frac{mi}{hr}$

$\left(\frac{14}{3}\pi \frac{ft}{s}\right)\left(\frac{60\,mi/hr}{88\,ft/sec}\right) = 3.\overline{18}\pi\ mi/hr$

≈ 10 mph

(b) Distance as function of # of revolutions of pedal.

$\left(\frac{1\text{ rev pedal}}{sec}\right)\left(\frac{2\text{rev wheel}}{1\text{ rev. pedal}}\right)\left(\frac{1}{12}\frac{ft}{in.}\right)\left(\frac{60\,mi/hr}{88\,ft/sec}\right)$

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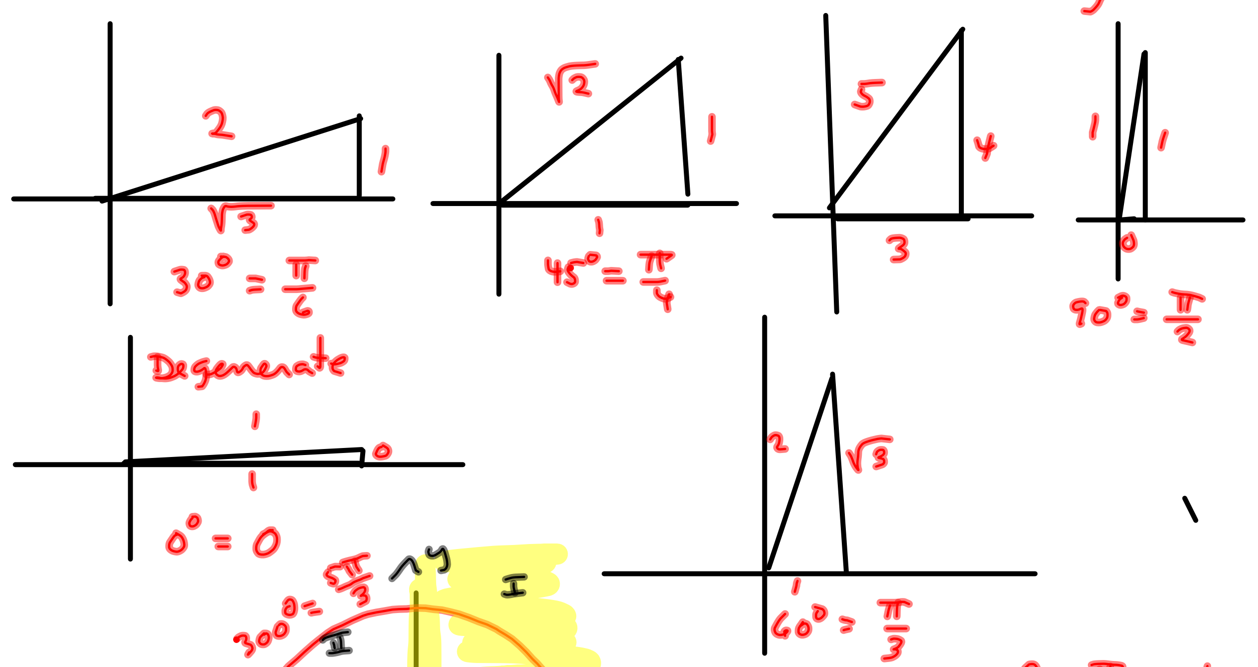
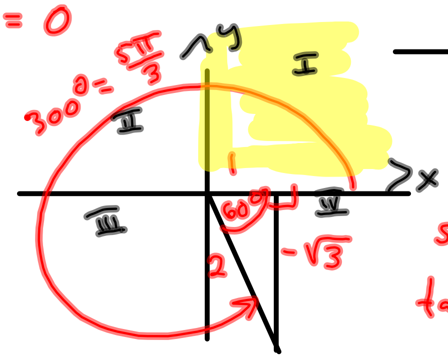
$\sin^2\theta + \cos^2\theta = 1$

Special Degenerate





$\sin\frac{5\pi}{3} = -\frac{\sqrt{3}}{2}$

$\tan\frac{5\pi}{3} = -\sqrt{3}$

$\cos\frac{5\pi}{3} = \frac{1}{2}$

$60^\circ = \frac{\pi}{3}$ radians, is the REFERENCE ANGLE, measured from the x-axis.

$2\pi - \frac{\pi}{3} = \frac{5\pi}{3}$

2π: All the way around

$\frac{\pi}{3}$: less $\frac{\pi}{3}$ radians

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$(\sin\theta)^2 = \sin^2\theta$

Down the road ambiguities!

A power of sine — Sometimes $\sin^{-1}\theta$ is $\frac{1}{\sin\theta} = (\sin\theta)^{-1}$

Inverse Function — Sometimes $\sin^{-1}x$ (→ arcsin(x) is what I usually do.) means the angle θ whose sine is $\sin^{-1}x$

$f(x) = 2x-1$

$f^{-1}(x) = \frac{x+1}{2}$ so the

$x = 2y-1$

$x+1 = 2y$

$\frac{x+1}{2} = y = f^{-1}(x)$

power is actually saying take the inverse with respect to the operation of composition of functions, NOT Arithmetic (Multiplication).

$f(x) = 2x-1 \Rightarrow (f(x))^{-1} = \frac{1}{2x-1}$

$(f(x))(f(x))^{-1} = (2x-1)\left(\frac{1}{2x-1}\right) = 1$ = multiplicative identity in the real numbers

Operation is multiplication

But $(f \circ f^{-1})(x) = f(f^{-1}(x)) =$

$f\left(\frac{x+1}{2}\right) = 2\left(\frac{x+1}{2}\right) - 1 = x+1-1 = x$

Operation is function composition.

x = the identity function in function space and composition is "the product."

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