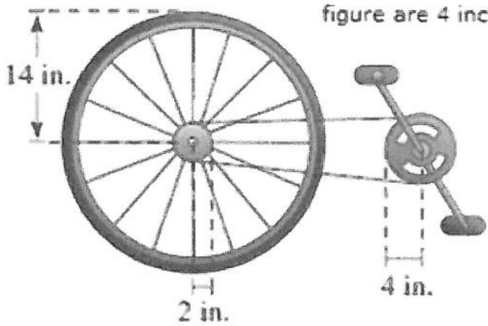
MAT 122 Section 1.1 #68, revisited.

1.1 #68

The radii of the pedal sprocket, the wheel sprocket, and the wheel of the bicycle in the figure are 4 inches, 2 inches, and 14 inches, respectively.



A cyclist is pedaling at a rate of 1 revolution per second.

(a) Find the speed of the bicycle in feet per second and miles per hour.

(b) Use your result from part (a) to write a function for the distance *d* (in miles) a cyclist travels in terms of the number *n* of revolutions of the pedal sprocket.

$$\left(\frac{1 \text{ rev front sprocket}}{1 \text{ sec}}\right)\left(\frac{2 \text{ revs rear sprocket}}{1 \text{ rev front sprocket}}\right) = \frac{2 \text{ revs rear}}{\text{sec}}$$

4 inches front, 2 inches rear

Rear revs $\frac{4}{2} = 2$ times

for every rev. on the front

Radius of rear wheel is 14 in & it revolves once every time the rear sprocket revolves.

$$\left(\frac{1 \text{ rev rear sprocket}}{\text{sec}}\right)\left(\frac{1 \text{ rev rear wheel}}{1 \text{ rev rear sprocket}}\right) = \frac{2 \text{ revs rear wheel}}{\text{sec}}$$

$s = r\theta$ & $\theta = 2\pi$ for one rev.

$$\left(\frac{2 \text{ revs Rear wheel}}{\text{sec}}\right)\left(\frac{2\pi \text{ radians}}{1 \text{ rev rear wheel}}\right) = \frac{4\pi \text{ radians rear}}{\text{sec}} = \frac{\theta}{\text{time}}$$

$$s = r\theta = (14 \text{ in})\left(\frac{4\pi \text{ rad}}{\text{sec}}\right) = 14(4\pi)\frac{\text{in}}{\text{sec}} = 56\pi \frac{\text{in}}{\text{sec}}$$

$$\left(\frac{56\pi \text{ in}}{\text{sec}}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = \frac{56\pi}{12}\frac{\text{ft}}{\text{sec}} = \boxed{\frac{14\pi}{3}\frac{\text{ft}}{\text{s}}} \approx \boxed{14.66076572} \frac{\text{ft}}{\text{sec}}$$

.122 $\not{S}$ 1.1 Sprockets!

$$\left(\frac{14\pi}{3}\right)\left(\frac{ft}{sec}\right)\left(\frac{60 \frac{mi}{hr}}{88 \frac{ft}{sec}}\right) = \frac{35\pi}{11} \frac{mi}{hr}$$

$$\approx \boxed{9.99597662\overline{5} \frac{mi}{hr}} \approx 10.00 \frac{mi}{hr}$$

(b) Now model it as a function of revs on the front sprocket, n.

$$g\left(\frac{2 \text{ revs}}{1 \text{ sec}}\right) \approx \frac{9.996 \text{ mi}}{hr}$$

$$g\left(\frac{1 \text{ rev}}{sec}\right) \approx 4.997988313 \approx \frac{5 \text{ mi}}{1 \text{ hr}}$$

$$\left(\frac{1 \text{ rev}}{sec}\right)\left(\frac{3600 \text{ sec}}{hr}\right) = \frac{3600 \text{ rev}}{1 \text{ hr}}$$

'5' is close enough for this

So, f(3600 revs) "=" 5 mi

So $\frac{5 \text{ mi}}{3600 \text{ revs}} = \frac{1}{720} \frac{mi}{rev}$

Let n = # of revs. Then

$d = \boxed{d(n) = \frac{1}{720} n} \boxed{= .0013\overline{8}\ n}$

d as function of n.