23. –/3 points LarTrig10 1.1.504.XP. My Notes Ask Your T

A four-inch-diameter pulley on an electric motor that runs at 1800 revolutions per minute is connected by a belt to an eight-inch-diameter pulley on a saw arbor.

(a) Find the angular speed (in radians per minute) of each pulley.
motor pulley (No Response) radians per minute
saw arbor (No Response) radians per minute

(b) Find the revolutions per minute of the saw.
(No Response) revolutions per minute

Recall
Radian Measure
$\theta = \frac{s}{r}$, where
θ = angle measure (IN RADIANS)
s = arc length
r = radius
$\Rightarrow \boxed{s = r\theta}$
Arc length = radius times angle
(only works for radians!!)

$\frac{\pi}{4}$ Radians $= \frac{\pi}{4}$ is unit-less

$30^\circ \neq 30$

Also, $D = rt$
r = rate
t = time
D = Distance
Not the same as radius

We have $\frac{\text{revs}}{\text{min}}$ on pulley → on motor. & Diameter. We want
(a) angular speed (in $\frac{\text{radians}}{\text{minute}}$)
on 4-inch pulley on motor
& on 8-inch pulley on saw

$\frac{\text{Radians Motor Pulley}}{\text{minute}}$:
We have $\left(\frac{1800 \text{ Revs Motor Pulley}}{\text{min}}\right)\left(\frac{2\pi (\text{Radians})}{1 \text{ Rev Motor Pulley}}\right)$

$= \frac{(1800)(2\pi)(\text{Radians Motor Pulley})}{\text{minute}}$ = Angular speed of motor pulley

$= \boxed{3600\pi \frac{\text{radians}}{\text{min}}}$

Dad's legs 3 ft (stride)
Son's " 1.5 ft (stride)

(Dad takes 3 steps)$\left(\frac{3}{1.5}\frac{\text{Boy Steps}}{\text{Dad steps}}\right)$

Want: $\frac{\text{Radians Saw Pulley}}{\text{min}}$:

$\left(\frac{1800 \text{ Revs Motor Pulley}}{1 \text{ minute}}\right)\left(\frac{4 \text{ revs Saw Pulley}}{8 \text{ revs Motor Pulley}}\right)\left(\frac{2\pi \text{ radians}}{1 \text{ rev Saw Pulley}}\right)$

$= \cancel{(1800)\left(\frac{1}{2}\right)(2\pi) = 1800\pi}$ UNITS!

$= (1800)\left(\frac{1}{2}\right)(2\pi)\frac{\text{radians motor pulley}}{\text{minute}}$ = the angular speed

$= \boxed{1800\pi \frac{\text{radians}}{\text{min}}}$ for saw.

(b) Revs/min for saw:
→ Already did this: $(1800)\left(\frac{1}{2}\right)\frac{\text{revs}}{\text{min}} = \boxed{900 \frac{\text{revs}}{\text{min}} \text{ for saw.}}$

This work is in the notes and videos on harryzaims.com

What's the area of a circle of radius r? πr^2

What's the angle in radians corresponding to one full revolution? 2π

So Area $= A(\theta) \Rightarrow$

$A(2\pi) = \pi r^2 = \frac{1}{2}(2\pi) r^2$

$\Rightarrow A(\theta) = \frac{1}{2}\theta r^2$

Relates to #22 S 1.1

$\theta = 130^\circ$, $r = 15$ m, find area

$A(\theta) = \frac{1}{2} r^2 \theta = \frac{1}{2}(15\text{m})^2 (130^\circ)\left(\frac{\pi}{180^\circ}\right)$

$= \frac{(225)(130)\pi}{2(180)} = \frac{(25)(13)\pi}{4} =$

$\frac{25 \cdot 13 \cdot \text{Pi}}{4}$

$\frac{325\,\pi}{4}$

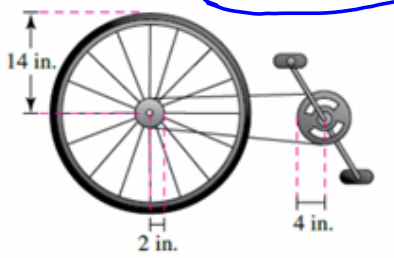
$\frac{1}{2} \cdot \frac{15^2 \cdot 130 \cdot \text{Pi}}{180}$

$\frac{325\,\pi}{4}$

evalf (%)

255.2544031

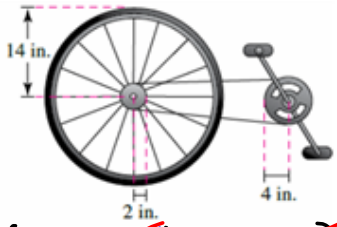
The radii of the pedal sprocket, the wheel sprocket, and the wheel of the bicycle in the figure are 4 inches, 2 inches, and 14 inches, respectively. A cyclist pedals at a rate of 1 revolution per second.



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

$\frac{14\pi}{3}$ feet per second

$\frac{35\pi}{11}$ mph



Want speed of bike in $\frac{ft}{s}$

We have $\frac{1 \text{ rev Front}}{s}$

$\frac{t}{2} = 2$

$$\left(\frac{1 \text{ rev Front}}{s}\right)\left(\frac{4 \text{ rev Rear}}{2 \text{ rev Front}}\right)\left(\frac{2\pi \text{ radians}}{1 \text{ rev Rear}}\right)(14 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)$$

unit-less

Angle/sec

$\frac{2\pi \text{ radians}}{\text{revolution}}$ is $\frac{2\pi}{\text{revolution}}$

(Radians are "unit-less".)

$S = r\theta$

arclength = radius · Angle

$\frac{\text{arclength}}{\text{sec}} = \frac{\text{radius} \cdot \text{Angle}}{\text{sec}}$

$(1)\left(\frac{4}{2}\right)(2\pi)(14)\left(\frac{1}{12}\right)\frac{ft}{s}$

$= \frac{56\pi}{12} = \frac{14\pi}{3}\frac{ft}{s}$

I can remember 60 mph = 88 ft/s

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

$\frac{30 \text{ mi}}{hr} = 44\frac{ft}{s}$

$\frac{15 \text{ mi}}{hr} = 22\frac{ft}{s}$

$$\left(\frac{14\pi}{3}\frac{ft}{s}\right)\left(\frac{60 \text{ s}}{\text{min}}\right)\left(\frac{60 \text{ min}}{hr}\right)\left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right) = \frac{(14\pi)(3600)}{(3)(5280)}\frac{mi}{hr}$$

$= \frac{35\pi}{11}\frac{mi}{hr}$ = speed of bike