Section 4.1 hw Day 1

45. $r = 10$ in speed 24 ft/sec rev/min ?

$\frac{10 \text{ inches}}{1 \text{ rad}}$ $\frac{24 \text{ feet}}{\text{sec}}$ $1 \frac{2\pi \text{ rad}}{1 \text{ rev}}$

$$\frac{24 \text{ feet}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} = \frac{1440 \text{ ft}}{1 \text{ min}}$$

$$10 \text{ inches} \cdot \frac{1 \text{ foot}}{12 \text{ inches}} = \frac{\frac{5}{6} \text{ ft}}{1 \text{ rad}}$$

$$\frac{1440 \text{ ft}}{1 \text{ min}} \cdot \frac{1 \text{ rad}}{\frac{5}{6} \text{ ft}} = 1728 \frac{\text{rad}}{\text{min}}$$

$$\frac{1728 \text{ rad}}{1 \text{ min}} \cdot \frac{1 \text{ rev}}{2\pi \text{ rad}} \approx 275.02 \text{ rev/min}$$

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47. $d = 10$ in 2000 rev/min 12 teeth per inch

$r = 5$ in

$\frac{5 \text{ in}}{1 \text{ rad}}$ $\frac{2000 \text{ rev}}{1 \text{ min}}$

how many teeth cross in 1 second

teeth/sec ?

$$\frac{5 \text{ in}}{\text{rad}} \cdot \frac{12 \text{ teeth}}{1 \text{ in}} = \frac{60 \text{ teeth}}{\text{rad}} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} = \frac{120\pi \text{ teeth}}{1 \text{ rev}} \cdot \frac{2000 \text{ rev}}{1 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}}$$

12566.37061 teeth/sec

55. $r = 4\text{cm}$ $R = 7\text{cm}$

120 rpm

a. $\frac{\text{rad}}{\text{sec}}$ $\frac{7\text{cm}}{1\text{rad}}$ $\frac{120\text{ rev}}{1\text{ min}} \cdot \frac{1\text{ min}}{60\text{ sec}} = \frac{2\text{ rev}}{\text{sec}}$

$\frac{2\pi\text{ rad}}{1\text{ rev}} \times \frac{2\text{ rev}}{1\text{ sec}} = \frac{4\pi\text{ rad}}{1\text{ sec}}$

b. cm/sec $\frac{7\text{cm}}{1\text{ rad}} \cdot \frac{4\pi\text{ rad}}{1\text{ sec}} = \frac{28\pi\text{ cm}}{1\text{ sec}}$

c. $\frac{\text{rad}}{\text{sec}}$ $\frac{4\text{cm}}{1\text{rad}}$

$\frac{1\text{rad}}{4\text{cm}} \cdot \frac{28\pi\text{ cm}}{1\text{ sec}} = \frac{7\pi\text{ rad}}{1\text{ sec}}$

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56. $r = 1.2\text{m}$ 135 rpm

$\frac{1.2\text{m}}{\text{rad}}$ $\frac{2\pi\text{ rad}}{1\text{ rev}}$

a. $\frac{\text{rad}}{\text{sec}}$ $\frac{135\text{ rev}}{\text{m}} \cdot \frac{1\text{ m}}{60\text{ sec}} = \frac{2.25\text{ rev}}{\text{sec}} \cdot \frac{2\pi\text{ rad}}{1\text{ rev}} = \frac{4.5\pi\text{ rad}}{\text{sec}}$

b. meters/sec $\frac{4.5\pi\text{ rad}}{\text{sec}} \cdot \frac{1.2\text{m}}{\text{rad}} = \frac{5.4\text{m}}{\text{sec}}$

c. radius halfway $\frac{1}{2}(1.2) = .6\text{m}$

meters/sec

c. radius halfway $\frac{1}{2}(1.2\text{m}) = .6\text{m}$

$\frac{4.5\pi\text{ rad}}{\text{sec}} \cdot \frac{.6\text{m}}{\text{rad}}$ 2.7π m/sec

74. 28in = d r = 14in (wheels) | pedal sprocket d = 9in r = 4.5in

wheel sprocket 3in = d
r = 1.5in

66 ft/sec = linear speed

radians/sec

wheel $\frac{14\text{in}}{1\text{rad}}$ $\frac{2\pi\text{ rad}}{1\text{ rev}}$

$\frac{66\text{ ft}}{\text{sec}}$ $\frac{14\text{ in}}{1\text{ rad}} \cdot \frac{1\text{ ft}}{12\text{ in}} = \frac{7/6\text{ ft}}{1\text{ rad}}$

$\frac{1\text{ rad}}{7/6\text{ ft}} \cdot \frac{66\text{ ft}}{\text{sec}}$ 56.57 rad/sec angular velocity of wheel

∴ wheel sprocket has the same angular speed as the wheel

pedal $\frac{4.5\text{ in}}{1\text{ rad}}$ $\frac{56.57\text{ rad}}{\text{sec}}$

$\frac{1.5\text{in}}{1\text{rad}} \cdot \frac{56.57\text{ rad}}{1\text{ sec}} = 84.855\text{ in/sec}$ linear speed of sprockets

$\frac{84.855\text{ in}}{\text{sec}} \cdot \frac{1\text{rad}}{4.5\text{in}} = 18.86\ \text{rad/s}$