

Solutions

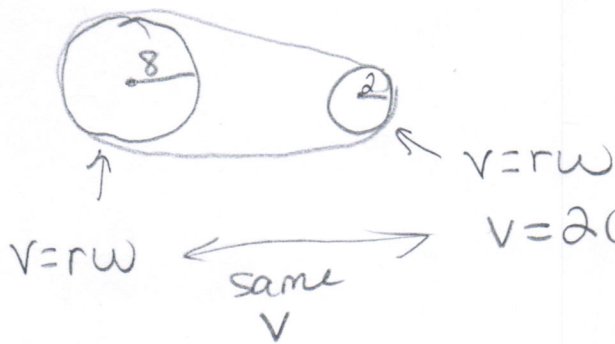
$$1. \quad 3 \frac{\text{rev}}{\text{min}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = 6\pi = \omega$$

$$V = r\omega$$

$$V = 15 \cdot 6\pi = 90\pi \frac{\text{in.}}{\text{sec.}} \quad \text{or} \quad 90\pi \frac{\text{in.}}{\text{sec.}} \cdot \frac{60 \text{ sec.}}{1 \text{ min.}} \cdot \frac{60 \text{ min.}}{1 \text{ hr.}} \cdot \frac{1 \text{ ft.}}{12 \text{ in.}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft.}}$$

$$V \approx 28274 \frac{\text{in.}}{\text{sec.}} \quad \text{or} \quad V \approx 16,065 \text{ mph}$$

2.



$$3 \frac{\text{rev.}}{\text{min.}} \cdot \frac{2\pi \text{ rad.}}{1 \text{ rev.}} = 6\pi \frac{\text{rad.}}{\text{min.}}$$

$$12\pi = 8 \cdot \omega$$

$$\frac{12\pi}{8} = \omega$$

$$\omega = \frac{3\pi}{2} \rightarrow$$

$$\frac{3\pi}{2} \frac{\text{rad.}}{\text{min.}} \cdot \frac{1 \text{ rev.}}{2\pi \text{ rad.}} = \boxed{\frac{3}{4} \frac{\text{rev}}{\text{min.}}}$$

$$3. \quad r = 30 \text{ ft.}$$

$$\omega = \frac{1}{70} \frac{\text{rev.}}{\text{sec.}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = \frac{2\pi}{70} \frac{\text{radians}}{\text{sec.}} = \frac{\pi}{35} \frac{\text{radians}}{\text{sec.}} = \omega$$

$$V = 30 \left(\frac{\pi}{35} \right) = \boxed{\frac{6\pi}{7} \frac{\text{ft.}}{\text{sec.}}}$$

$$4. \quad r = 13 \text{ in.}$$

$$V = 35 \frac{\text{miles}}{\text{hr.}} \cdot \frac{5280 \text{ ft.}}{1 \text{ mile}} \cdot \frac{12 \text{ in.}}{1 \text{ ft.}} \cdot \frac{1 \text{ hr.}}{60 \text{ min.}} = 36960 \frac{\text{in.}}{\text{min.}}$$

$$V = r \cdot \omega$$

$$36960 = 13 \cdot \omega$$

$$\omega \approx 2843.0769 \frac{\text{radians}}{\text{min.}} \rightarrow \cdot \frac{1 \text{ rev.}}{2\pi \text{ radians}} \rightarrow \boxed{452.5 \text{ rpm}}$$

5. $r = 4 \text{ ft.}$

$$10 \frac{\text{rev}}{\text{min}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = 20\pi \frac{\text{radians}}{\text{min.}} = \omega$$

$$v = 4 \cdot 20\pi \frac{\text{ft.}}{\text{min.}} \cdot \frac{60 \text{ min}}{1 \text{ hr.}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft.}} \approx \boxed{2.86 \text{ mph}}$$

6. $r = 13 \text{ in.}$

$$480 \frac{\text{rev}}{\text{min.}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = \omega$$

$$v = 13 \cdot 960\pi = 12480\pi \frac{\text{in.}}{\text{min.}} \cdot \frac{1 \text{ ft.}}{12 \text{ in.}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft.}} \cdot \frac{60 \text{ min}}{1 \text{ hour}}$$

$$\boxed{v \approx 37.13 \text{ mph}}$$

7. $v = 9.55 \frac{\text{miles}}{\text{hour}}$ $r = 4.25 \text{ ft.} = 4.25 \text{ ft.} \cdot \frac{1 \text{ mile}}{5280 \text{ ft.}} = .000805 \text{ miles}$

$$9.55 = .000805 \cdot \omega$$

$$\omega = 11864.47059 \frac{\text{radians}}{\text{hour}}$$

$$11864.47059 \frac{\text{rad}}{\text{hour}} \cdot \frac{1 \text{ hour}}{60 \text{ min}} \cdot \frac{1 \text{ rev}}{2\pi \text{ rad}} \Rightarrow \boxed{31.47 \text{ rpm}}$$

8. $200 \frac{\text{rev}}{\text{min}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = \boxed{400\pi \frac{\text{radians}}{\text{min.}}} = \omega$

$$v = 2 \cdot 400\pi = \boxed{800\pi \frac{\text{in.}}{\text{min.}}}$$

$$800\pi \frac{\text{in.}}{\text{min.}} \cdot \frac{1 \text{ ft.}}{12 \text{ in.}} = \boxed{400\pi \frac{\text{ft}}{\text{min.}}}$$

9. $r = 7.5$ inches

$$2.5 \frac{\text{rev.}}{\text{sec.}} \cdot \frac{2\pi \text{ radians}}{1 \text{ rev.}} = \boxed{5\pi \frac{\text{radians}}{\text{sec.}} = \omega}$$

$$v = 7.5 (5\pi) = 37.5\pi \frac{\text{in}}{\text{sec.}} \cdot \frac{1 \text{ ft.}}{12 \text{ in.}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft.}} \cdot \frac{60 \text{ sec.}}{1 \text{ min.}} \cdot \frac{60 \text{ min.}}{1 \text{ hr.}}$$

$$\boxed{v = 6.69 \text{ mph}}$$

10. $v = 10 \frac{\text{ft.}}{\text{sec.}}$ $6 \frac{\text{rev.}}{\text{min.}} \cdot \frac{2\pi \text{ rad.}}{1 \text{ rev.}} \cdot \frac{1 \text{ min.}}{60 \text{ sec.}} = \frac{12\pi}{60} \frac{\text{radians}}{\text{sec.}} = \frac{\pi}{5} \frac{\text{rad.}}{\text{sec.}}$

$$10 = r \cdot \frac{\pi}{5}$$

$$10 \cdot \frac{5}{\pi} = r$$

$$\boxed{\frac{50}{\pi} = r \approx 15.915 \text{ ft.}}$$