Velocity ??

$V = \dfrac{distance}{time}$

$V = \dfrac{d}{t}$
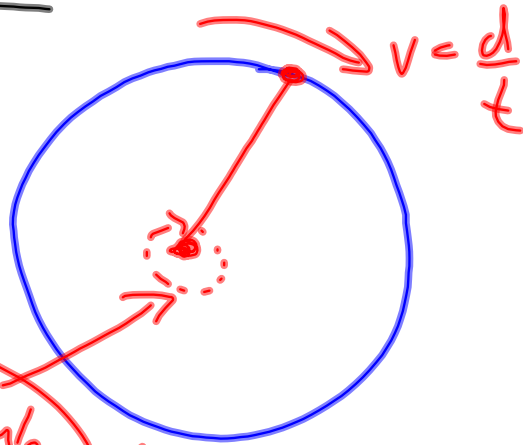
1 Rev / 2 seconds

Angular Velocity

degrees or Radians

Angular Velocity

Angular velocity - amount of rotation around a central point per unit of time

$$v_a = \frac{\theta}{t} \qquad\qquad \theta = \frac{a}{r}$$

θ = angle (radians)

v_a = angular velocity

a = arc length

t = time

r = radius

Ex. The roller on a computer printer makes 2200 rpm (revolution per minute).
Find the roller's angular velocity.

$$\boxed{1 \text{ Rev} = 2\pi \text{ Rad}} \qquad \frac{2200 \text{ Rev}}{1 \text{ min}}$$

$$V_A = \frac{2200(2\pi) \text{ Rad}}{1 \text{ Minute}}$$

$$V_A = 4400\pi \frac{\text{Rad}}{\text{Min.}} \times \frac{1 \text{ min}}{60 \text{ sec}} = \boxed{\frac{220\pi \text{ Rad/sec}}{3}}$$

$$\text{OR}$$

$$V_A = \frac{2200(360°)}{60 \text{ sec}} = 13200°/\text{sec}$$

2/ A windmill makes 1 Revolution in 4.3 seconds. Angular Velocity??

$$V_a = \frac{\theta}{t} = \frac{2\pi \text{ Rad}}{4.3 \text{ sec}}$$

$$= 1.46 \text{ Rad/sec}$$

Ex. (a) If wheel 1 rotates 40 radians, how far has the belt traveled?

(b) Given the 40 rad rotation of wheel 1, what was the angle of rotation for wheel 2?
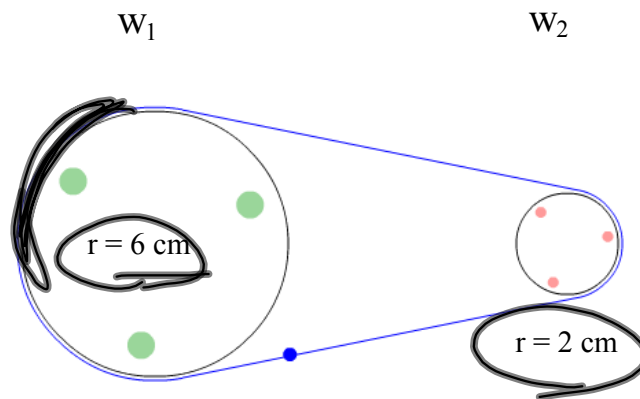
W_1 W_2

r = 6 cm

r = 2 cm

(a) arc ??

$\theta = \dfrac{a}{r}$

$a = \theta r$

$a = (40)(6 \text{ cm})$

$a = 240 \text{ cm}$

(b) Ratio: 1 : 3
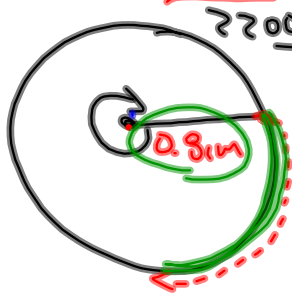
40 Rad ⟹ 120 Rad

(b) arc ≈ 240 cm
radius = 2 cm

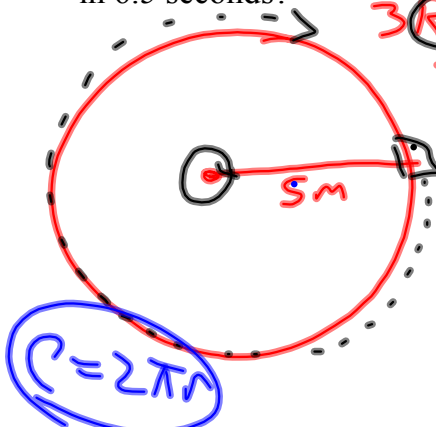$\theta = \dfrac{240 \text{ cm}}{2 \text{ cm}} = 120 \text{ Rad}$

Ex. A small electrical motor turns at 2200 rpm.

(a) Express the angular velocity in rad/s.
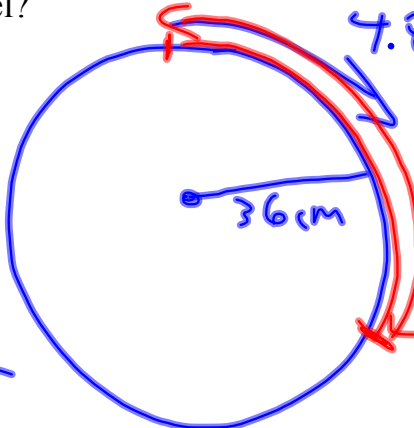(b) Find the distance a point 0.8cm from the center of rotation
   travels in 0.008 s.

(a) 2200 RPM

$$V_A = \frac{2200(2\pi)Rad}{60\ sec}$$

$$V_A = \frac{220\pi}{3}\ \frac{Rad}{Sec}$$

$$\partial = \frac{220\pi Rad}{3}\frac{1}{s} \times 0.008\ sec = 1.843\ Rad$$

(b) arc?

$$\theta = \frac{a}{r}$$

$$a = \partial r$$

$$a = (1.843)(0.8)$$

$$= 1.47\ cm$$

Ex. A Ferris Wheel rotates 3 times each minute. The passengers sit in seats
that are 5 m from the center of the wheel. What is the angular velocity of
the wheel in radians per second? What distance do the passengers travel
in 6.5 seconds?

$$3\frac{Rev}{60\ sec} \Rightarrow \partial = 3(2\pi) = 6\pi\ Rad$$

$$V_A = \frac{6\pi Rad}{60\ sec} = \frac{\pi}{10}\ Rad/sec$$

$$C = 2\pi r$$

arc??

$$\theta = \frac{a}{r}$$

$$a = \partial r$$

$$a = \left(\frac{6.5\pi}{10}\ Rad\right)(5m)$$

$$a = 10.21\ m.$$

$$V_A = \frac{\theta}{t}$$

$$\theta = V_A \times t$$

$$\theta = \frac{\pi}{10}\frac{Rad}{s} \times 6.5\ sec$$

Ex. A bicycle wheel has a radius of 36 cm and is turning at 4.8m/s. Determine the angula
velocity of this wheel?

$$V_A = \frac{\theta}{t}$$

4.8m/s

36cm

Arc associated with 1 second

$$\theta = \frac{a}{r}$$

$$V_A = \frac{13.\bar{3} \, Rad}{1 \, sec}$$

$$V_A = 13.\bar{3} \, Rad/sec$$

$$\theta = \frac{4.8m}{0.36m} = 13.\bar{3} \, R$$

ex. Car wheel of diameter 48cm travelling 80 km/h. What is angular velocity in Rad/sec?

92.59 Rad/sec

$$\frac{80 \, km}{h} \times \frac{10^3 \, m}{1 \, km} \times \frac{1 \, h}{3600 \, sec} = 22.2 \, m/s$$

22.2 m/s

r=0.24m

$$V_A = \frac{\theta}{t}$$

$$\theta = \frac{a}{r} = \frac{22.2m}{0.4m}$$

$$\frac{92.59 \, Rad}{1 \, sec}$$

$$= 92.59 \, Rad$$
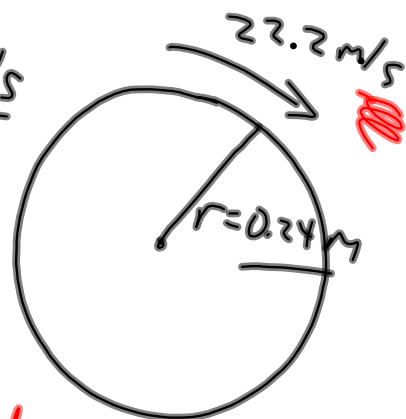
Practice Problems...

Page 176 - 179
#14, 15, 16, 19, 20 a, b , 21, 22, 23, 24, 25, 26, 27