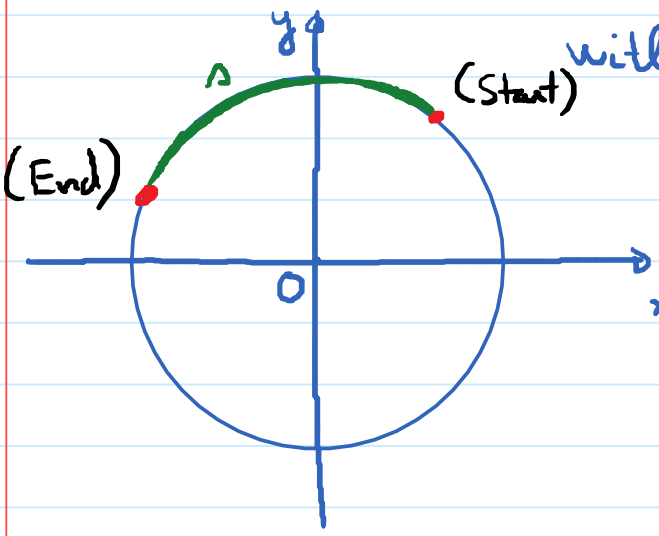
3.4. Linear Speed and Angular Speed.

Thursday, February 21, 2019 8:44 AM

① Linear Speed.

Point P moves along the circle with constant speed.



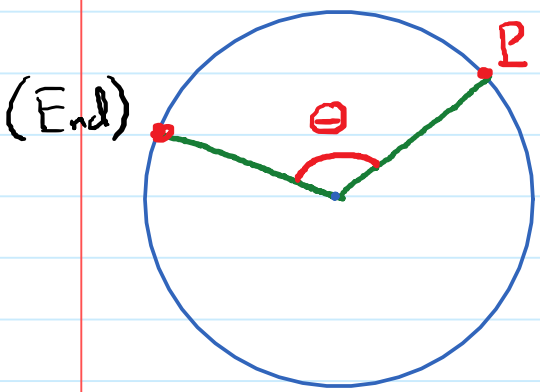
Linear speed of P is the measure of how fast the position of P changes along the circle.

$$v = \frac{s}{t}$$

v: linear speed. (m/s; mi/h, inch/min ...)

s: arc length

t: time it takes for P to trace through an arc of length s.



The angular speed of P is the measure of how fast the angle is changing.

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

ω: angular speed. (rad/min, degrees/hr ...)

t: time it takes for P to trace through an angle θ.

$$v = \frac{s}{t} \quad , \quad \omega = \frac{\theta}{t}$$

Q: How are v and ω related

Know: $s = R \cdot \theta$ (R: radius of circle)

$$v = \frac{s}{t} = \frac{R \cdot \theta}{t} = R \cdot \underbrace{\frac{\theta}{t}}_{\omega} = R \cdot \omega$$

So, $v = R \cdot \omega$ → Relationship between linear and angular speed.

$$\omega = \frac{v}{R} \qquad R = \frac{v}{\omega}$$

Eg. Bicycle problem:

$$\omega = 200 \cdot 2\pi = 400\pi \text{ rad/min}$$

$$v = R \cdot \omega = 14 \cdot 400\pi = 17952.92 \text{ inch/min}$$

$$17952.92 \text{ inch/min} \rightarrow 1466.1 \text{ ft/min} \rightarrow 0.277666 \text{ mi/min}$$

$$\rightarrow 16.7$$