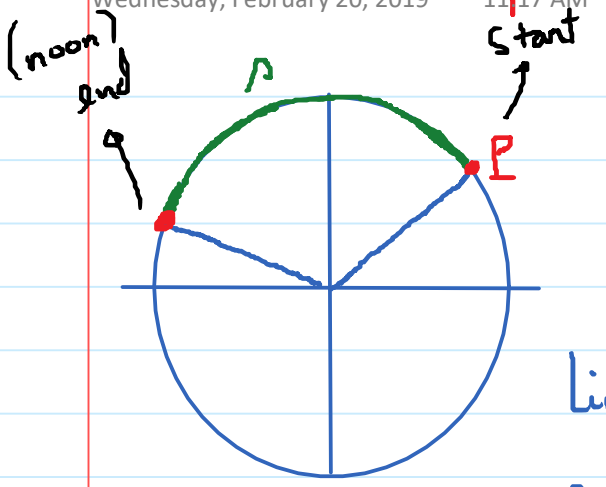
3.4. Linear Speed and Angular Speed

Wednesday, February 20, 2019 11:17 AM



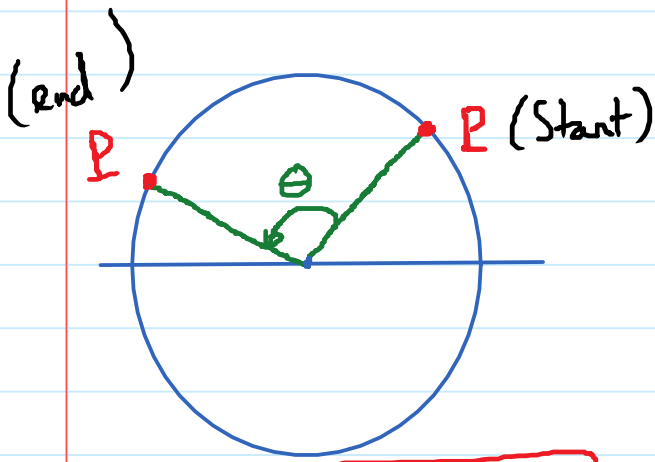
Point P moves along the circle with constant speed

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

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

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

w: angular speed

t: time it takes P to trace through an angle θ. (θ is measured in radians)

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

Q: How is v and ω related?

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

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

So, $\boxed{v = R \cdot \omega}$ → relationship between linear and angular speed.

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

E.g. Bicycle problem.

Linear speed $v = R \cdot \omega = 14 \cdot (205 \cdot 2\pi)$

inch; rad/min

$v = 18032.74183$ (inch/min)

$v = 1502.728486$ (ft/min) → 0.28461 (mi/min) → 17.1 mi/hr