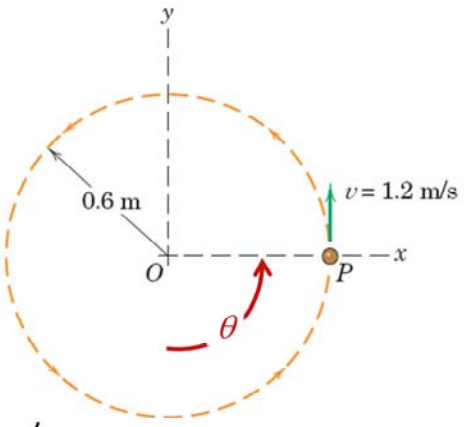
Circular Motion: Exercise

Particle *P* moves in a circular path shown.



Determine the magnitude of ***acceleration*** for:

(a) constant ***velocity*** 1.2 m/s
(b) ***velocity*** 1.2 m/s and increasing 2.4 m/s each second
(c) ***velocity*** 1.2 m/s and decreasing 4.8 m/s each second

$v_\theta = r\dot{\theta}$

$a_r = -r\dot{\theta}^2$

$a_\theta = r\ddot{\theta}$

ME 231: Dynamics 13

See Notes Page view for solution.

a) $v_\theta = r\dot{\theta} \quad \dot{\theta} = \dfrac{v_\theta}{r} \quad \dot{\theta} = \dfrac{1.2}{0.6} = 2 \text{ rad/s} \quad a_\theta = r\ddot{\theta} = (0.6)(0) = 0$

$a_r = -r\dot{\theta}^2 = -(0.6)(2^2) = -2.4 \text{ m/s}^2 \quad a = \sqrt{a_r^2 + a_\theta^2} = 2.4 \text{ m/s}^2$

b) $a_\theta = 2.4 \text{ m/s}^2 \quad a = \sqrt{a_r^2 + a_\theta^2} = \sqrt{(-2.4)^2 + 2.4^2} = 3.39 \text{ m/s}^2$

c) $a_\theta = -4.8 \text{ m/s}^2 \quad a = \sqrt{a_r^2 + a_\theta^2} = \sqrt{(-2.4)^2 + (-4.8)^2} = 5.37 \text{ m/s}^2$