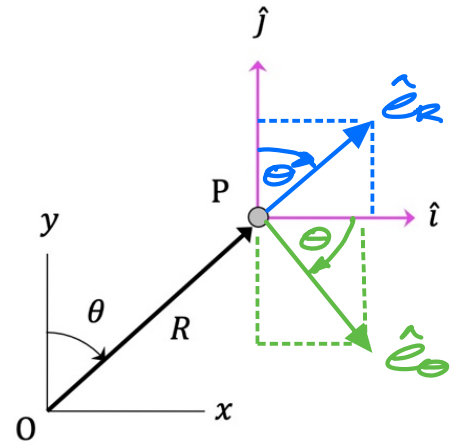


Quiz #1

Problem Q1

A fixed observer at point O watches the motion of particle P through that radial distance R and the angle θ .

- Include a sketch of the polar unit vectors \hat{e}_R and \hat{e}_θ in the figure.
- Write down the unit vectors \hat{e}_R and \hat{e}_θ in terms of their Cartesian coordinates.



From figure:

$$\hat{e}_R = \sin\theta \hat{i} + \cos\theta \hat{j}$$

$$\hat{e}_\theta = \cos\theta \hat{i} - \sin\theta \hat{j}$$

Problem Q2

The velocity and acceleration of a particle P are known in terms of their polar coordinates:

$$\vec{v} = (12\hat{e}_R - 15\hat{e}_\theta) \text{ m/s}$$

$$\vec{a} = (-10\hat{e}_\theta) \text{ m/s}^2$$

Determine the rate of change of speed of P. Is P *increasing in speed*, *decreasing in speed* or *moving at a constant speed*?

$$\dot{v} = \vec{a} \cdot \hat{e}_t = \vec{a} \cdot \frac{\vec{v}}{|\vec{v}|} = (-10\hat{e}_\theta) \cdot \left(\frac{12\hat{e}_R - 15\hat{e}_\theta}{\sqrt{12^2 + 15^2}} \right) = \frac{150}{\sqrt{369}} \frac{\text{m}}{\Delta^2}$$

Since $\dot{v} > 0 \Rightarrow$ **INCREASING** in speed