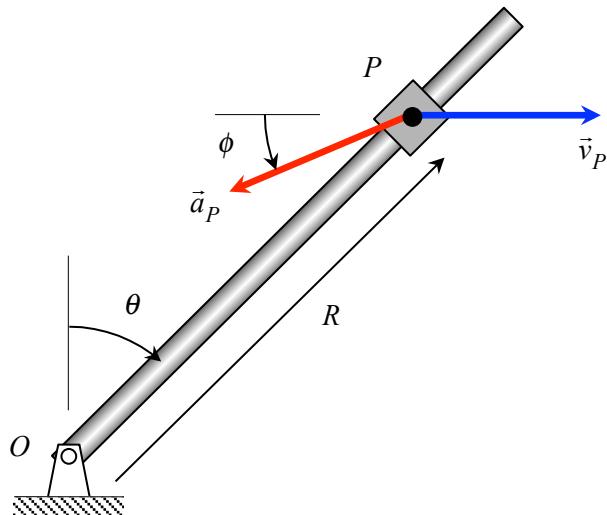


**Homework H1.F**

**Given:** Particle P is able to slide along an arm that is rotating about end O. At the instant shown, the arm is at an angle of  $\theta$  measured clockwise from the vertical, the velocity of P is known to be horizontal, and the acceleration of P is in a direction defined by the angle  $\phi$  from the horizontal, all as shown in the figure.

**Find:** For position of  $\theta = 30^\circ$ :

- show the position of P and the polar unit vectors  $\hat{e}_R$  and  $\hat{e}_\theta$ , along with  $\vec{v}_P$  and  $\vec{a}_P$ , in a sketch.
- determine numerical values for  $\dot{R}$ ,  $\ddot{R}$ ,  $\dot{\theta}$  and  $\ddot{\theta}$ .



Use the following parameters in your work:  $\phi = 20^\circ$ ,  $R = 2\text{m}$ ,  $|\vec{v}_P| = 8 \text{ m/s}$  and  $|\vec{a}_P| = 20 \text{ m/s}^2$ .