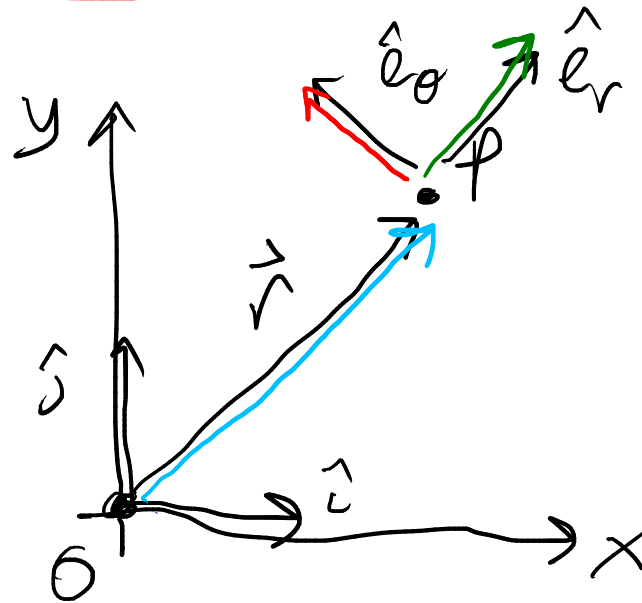
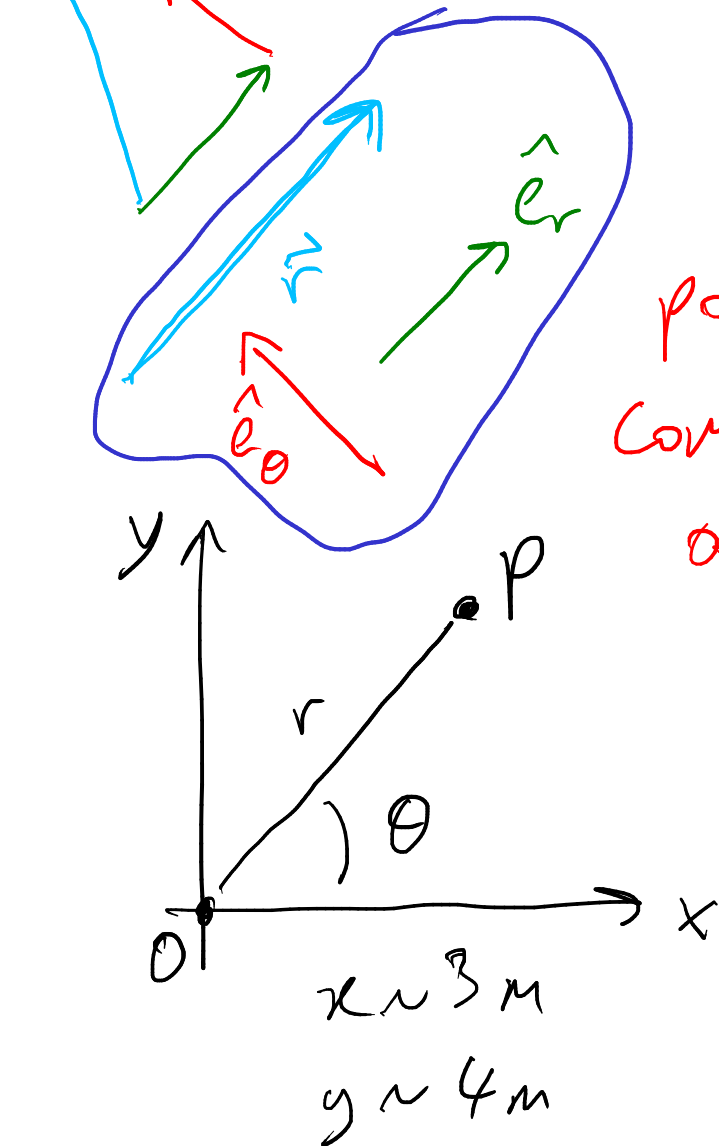


positions \rightarrow coordinates $r=5m, \theta=60^\circ$

position vectors \rightarrow components $\left\{ \begin{array}{l} \text{polar coordinates} \\ \text{of } P \end{array} \right.$

$$\begin{aligned}\vec{r} &= \overrightarrow{OP} \\ &= \underline{3} \hat{i} + \underline{4} \hat{j} \\ &= \underline{5m} \hat{e}_r + \underline{0} \hat{e}_\theta\end{aligned}$$

polar
components
of \vec{r}

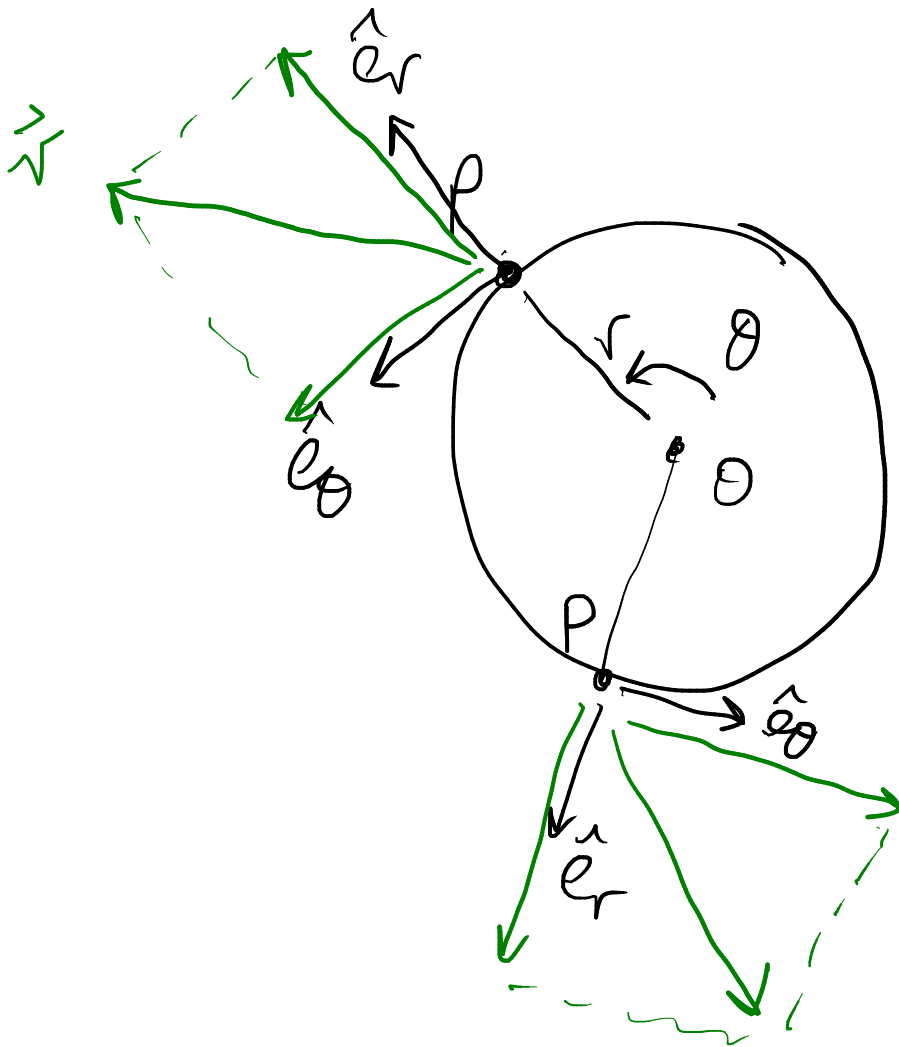


$$\vec{r} = r \hat{e}_r$$

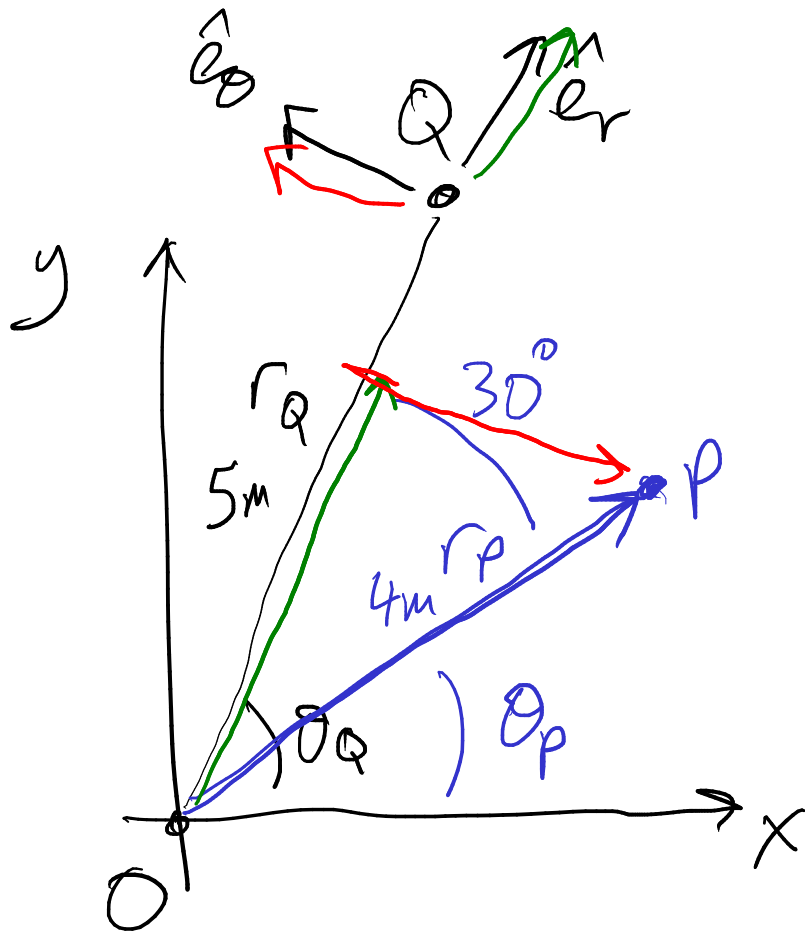
$$\vec{v} = \dot{\vec{r}} = \dot{r} \hat{e}_r + r \dot{\hat{e}}_r = \dot{r} \hat{e}_r + r \dot{\theta} \hat{e}_\theta$$

$$\left. \begin{array}{l} r \text{ increasing} \\ \dot{r} > 0 \end{array} \right\} \dot{r} \hat{e}_r$$

$$\left. \begin{array}{l} \theta \text{ increasing} \\ \omega = \dot{\theta} > 0 \end{array} \right\} r \omega \hat{e}_\theta$$

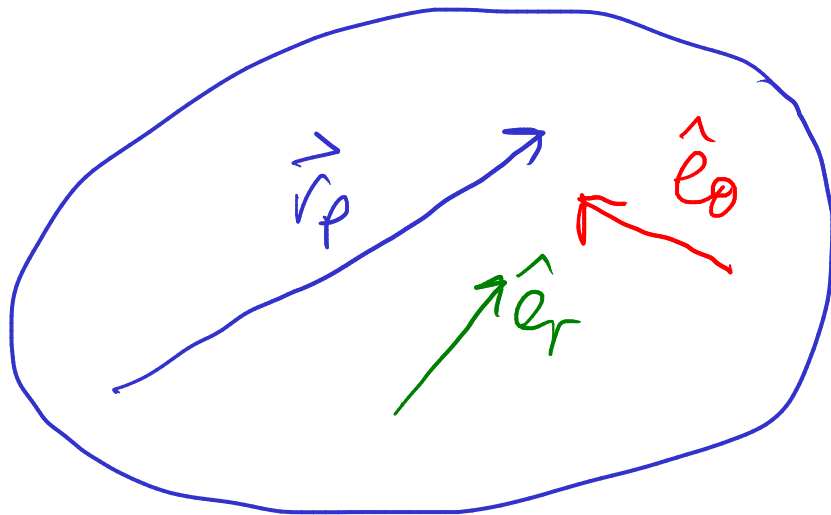


$$\left\{ \begin{array}{l} \dot{r} = 4 \text{ m/s} \\ \omega = 2 \text{ rad/s} \\ r = 1 \text{ m} \end{array} \right.$$



$$\begin{aligned}\vec{r}_Q &= \vec{OQ} \\ &= r_Q \hat{e}_r + 0 \hat{e}_\theta\end{aligned}$$

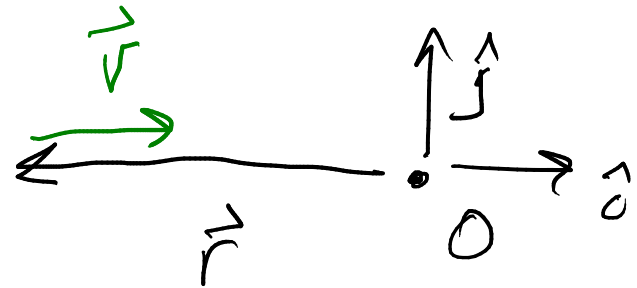
$$\begin{aligned}\vec{r}_P &= 3m \hat{e}_r + -2m \hat{e}_\theta \\ \uparrow &\quad \uparrow \\ \vec{OP} &\end{aligned}$$



speed $v = \sqrt{\dot{x}^2 + \dot{y}^2} \geq \sqrt{\dot{y}^2} = |\dot{y}|$

$$\vec{r} = -10\text{ m } \hat{z}$$

$$\vec{v} = 3\text{ m s}^{-1} \hat{x}$$



$$x = x_0 + \frac{v_0 t}{2} + \frac{1}{4} a_0 t^2$$