A. Same Qs

B. diff Qs

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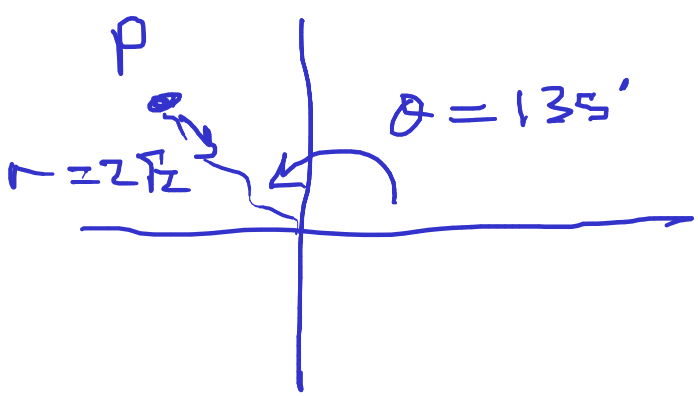
start $\begin{cases} x = -2 \\ y = 2 \end{cases}$ start at $t = 0$

t final

$\vec{r}\left(\frac{\pi}{2}\right)$?

$$\vec{r} = -\sqrt{2}\cos(-t)\,\hat{e}_r$$

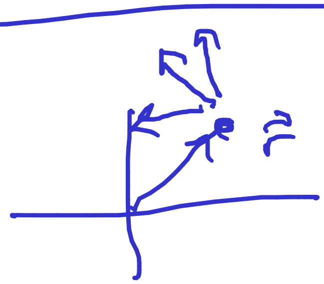
at $t = 0$



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

$$\begin{cases} \dot{r} = -\sqrt{2}\cos(-t) \\ \dot{\theta} = 0 \end{cases}$$

$$\theta\left(\frac{\pi}{2}\right) = \theta(0) = \frac{3\pi}{4}$$



$$r(t) = \sqrt{2}\sin(-t) + \underbrace{C}_{2\sqrt{2}}$$

$$r(0) = \sqrt{2}\sin(-0) + C = 2\sqrt{2}$$

$$r\left(\tfrac{\pi}{2}\right) = -\sqrt{2} + 2\sqrt{2} = \sqrt{2}$$

$$\theta\left(\tfrac{\pi}{2}\right) = 135^\circ$$

$\Bigg\}$ $x = -1$, $y = 1$

$\theta(t)$ $\quad t = \frac{\pi}{2}$ 5

$\vec{r} = 2\hat{i}$ $\quad \vec{\omega} = 3\hat{k}$ $\quad \vec{\alpha} = 4\hat{j}$ $\quad \vec{a}$? $\vec{v}$?

P rotating about origin $\longrightarrow$ radius not changing.

$$\vec{v} = \vec{\omega} \times \vec{r} = 6\hat{j}$$

$$\vec{a} = \vec{\alpha} \times \vec{r} + \vec{\omega} \times (\vec{\omega} \times \vec{r}) = -8\hat{k} - 18\hat{i}$$

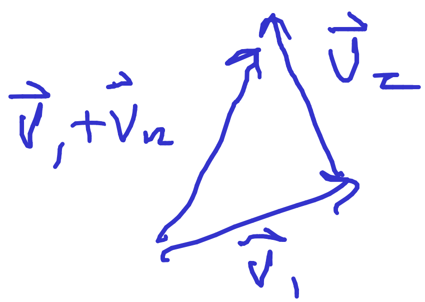
$\vec{r}$ is on the z axis

$\vec{\omega} = 2\hat{j}$ $\quad \vec{\alpha} = 3\hat{i}$ $\quad a = 10$ $\quad \vec{r}$? $\quad r$?

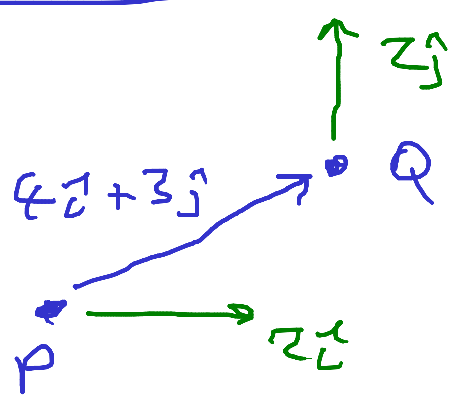
$$\vec{a} = \vec{\alpha}\times\vec{r} + \vec{\omega}\times(\vec{\omega}\times\vec{r})$$

$$10 = a = \|\vec{a}\| = \|\vec{\alpha}\times\vec{r} + \vec{\omega}\times(\vec{\omega}\times\vec{r})\|$$

$$\vec{r} = r_z\hat{k}$$



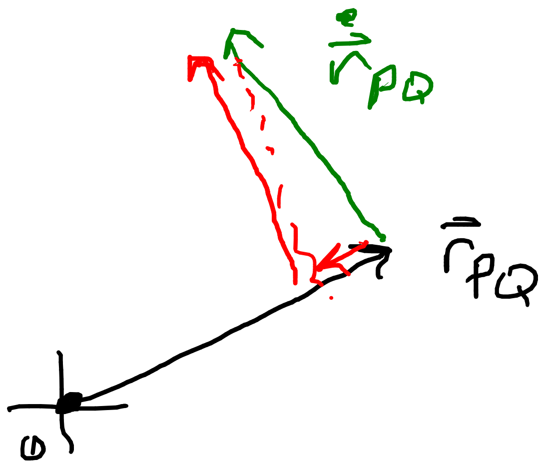
1. vector eqn → scalar eqn
2. introduce scalar vars.



$\dot{r}_{PQ}$?

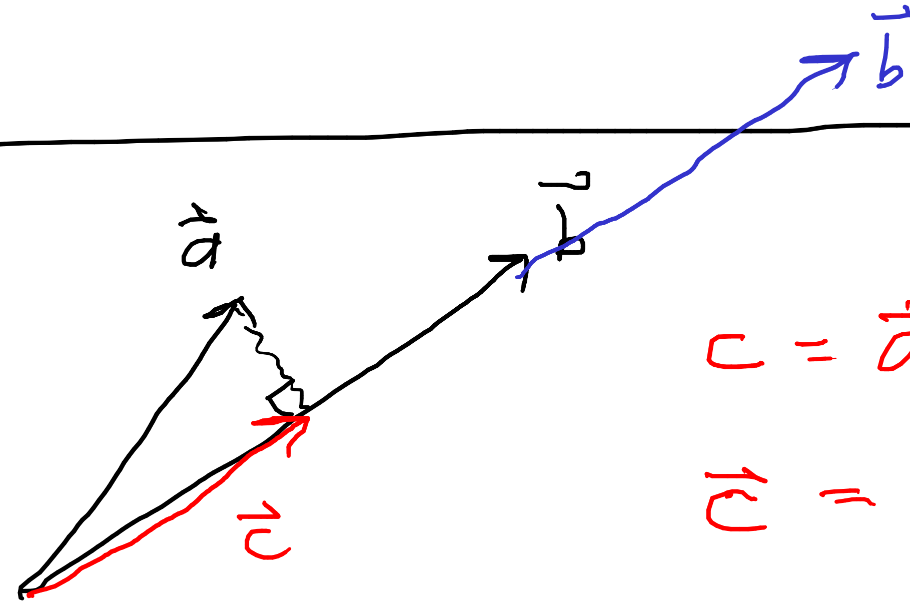
$$\vec{r}_{PQ} = \vec{r}_Q - \vec{r}_P = 4\hat{i}+3\hat{j}$$

$$\dot{\vec{r}}_{PQ} = \vec{v}_Q - \vec{v}_P$$



$$= -2\hat i + 2\hat j$$

$$\dot r_{PQ} = \dot{\vec r}_{PQ} \cdot \hat r_{PQ} = -0.4$$



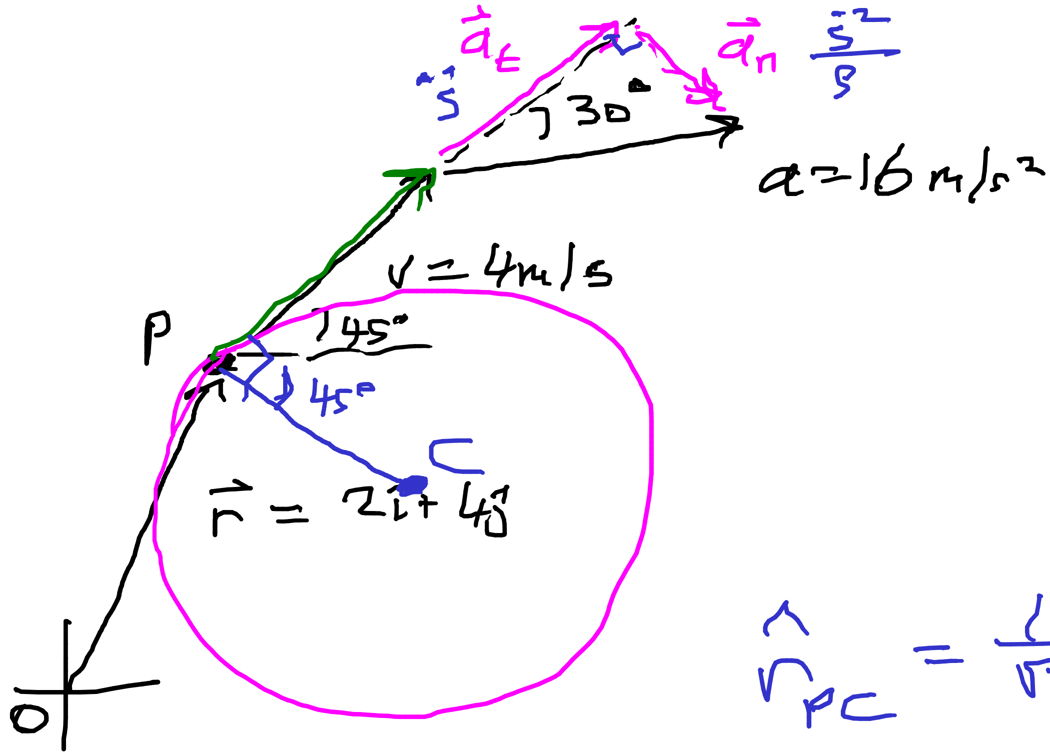
$$c = \vec a \cdot \hat b$$

$$\vec c = proj(\vec a, \vec b)$$

$$= (\vec a \cdot \hat b)\,\hat b$$

$$\vec r = r\,\hat r$$

$$\dot{\vec r} = \underbrace{\dot r\,\hat r}_{\text{length change}} + \underbrace{r\,\dot{\hat r}}_{\text{dir change}}$$



Where is center C of osc. circle?

$$\hat{r}_{PC} = \frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j} = \hat{e}_n$$

$$r_{PC} = \rho$$

$$\frac{\hat{i} - \hat{j}}{\sqrt{2}}$$

$$\vec{a} = \underbrace{\ddot{s}\,\hat{e}_t}_{\vec{a}_t} + \underbrace{\frac{\dot{s}^2}{\rho}\hat{e}_n}_{\vec{a}_n}$$

$\dot{s} = 4$ $\quad a_n = 8 = \frac{\dot{s}^2}{\rho}$