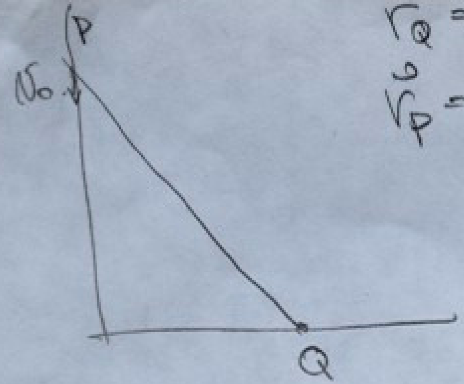
P1)



$\vec{r}_Q = x\hat{i}$ $\quad \vec{v}_Q = \dot{x}\hat{i}$

$\vec{r}_P = y\hat{j}$ $\quad \vec{v}_P = \dot{y}\hat{j}$

Ejercicio 1

Pauta

$$x^2 + y^2 = L^2$$

$$x = \sqrt{L^2 - y^2} \qquad d/dt$$

$$\Rightarrow$$

$$\dot{x} = \frac{1(-2y\dot{y})}{2\sqrt{L^2 - y^2}}$$

$$\dot{x} = -\frac{y\dot{y}}{\sqrt{L^2 - y^2}}$$

$$\boxed{\dot{y} = -v_0} \int_{t_0}^{t} dt \qquad \dot{x} = -\frac{(d - v_0 t)(-v_0)}{\sqrt{L^2 - (d - v_0 t)^2}}$$

$$\Rightarrow y = d - v_0 t$$

$$\Rightarrow \boxed{\vec{v}(t) = \frac{v_0(d - v_0 t)}{\sqrt{L^2 - (d - v_0 t)^2}}\hat{i}}$$

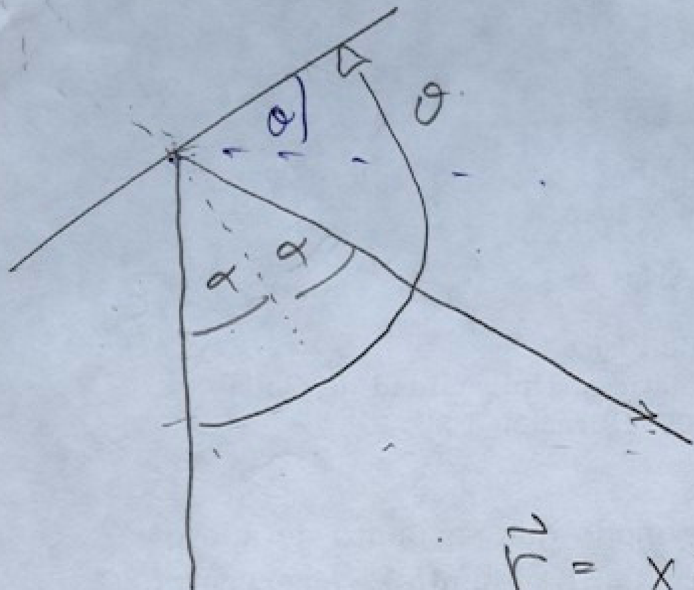
2) $\vec{v}(t^*) = v_0 \hat{i} \Rightarrow$

$$\sqrt{L^2 - (d - v_0 t)^2} = (d - v_0 t^*) \qquad /(\,)^2$$

$$L^2 = 2(d - v_0 t^*)^2$$

$$\frac{L}{\sqrt{2}} = d - v_0 t^* \Rightarrow \boxed{t^* = \frac{d - L/\sqrt{2}}{v_0}}$$

P2)



$$\pi - 2(\pi - \theta) = 2\alpha$$

$$\boxed{2\theta - \pi = 2\alpha}$$

$$tg(2\alpha) = \frac{D}{-y}$$

$$y = -D\,cotg(2\alpha)$$

$$\vec{r} = x\hat{\imath} + y\hat{\jmath}$$

$$= D\hat{\imath} - \frac{D}{tg(2\alpha)}\hat{\jmath}$$

$$= D\hat{\imath} - \frac{D\cos(2\alpha)}{sen(2\alpha)}\hat{\jmath}$$

$$= D\hat{\imath} - D\frac{\cos(2\theta - \pi)}{sen(2\theta - \pi)}\hat{\jmath} = D\left[\hat{\imath} + \frac{\cos(\pi - 2\theta)}{sen(\pi - 2\theta)}\hat{\jmath}\right]$$

$$\cos(\pi - 2\theta) = \cos\pi\cos 2\theta + sen\pi\, sen 2\theta$$
$$= -\cos 2\theta$$

$$sen(\pi - 2\theta) = sen\pi\cos(2\theta) - sen 2\theta\cos\pi$$
$$= sen\, 2\theta$$

$$\vec{r} = D\left[\hat{\imath} - \frac{\cos(2\theta)}{sen(2\theta)}\hat{\jmath}\right]$$

$$\vec{v} = \frac{d\vec{r}}{dt} = -D\left[\frac{-sen(2\theta)\cdot 2\dot{\theta}}{sen(2\theta)} - \frac{\cos(2\theta)\cdot\cos(2\theta)\cdot 2\cdot\dot{\theta}}{sen^2(2\theta)}\right]\hat{\jmath}$$

$$= 2D\dot{\theta}\left[sen^2 2\theta + \cos^2 2\theta\right]\hat{\jmath} = 2D\dot{\theta}\;\hat{\jmath}$$