Problem 1A

a520

$$\dot{P}_x = V\cos\theta$$
$$\dot{P}_y = V\sin\theta$$
$$\dot{\theta} = \frac{V}{L}\tan\phi$$

Under the controls $u = \begin{bmatrix} V \\ \phi \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ ...

$$\dot{\theta} = \frac{1}{0.4}\tan 0 = 0$$

Therefore $\theta(t) = \theta(0) = 0$. θ is *not* a function of time under these controls. Rather it is constant zero.

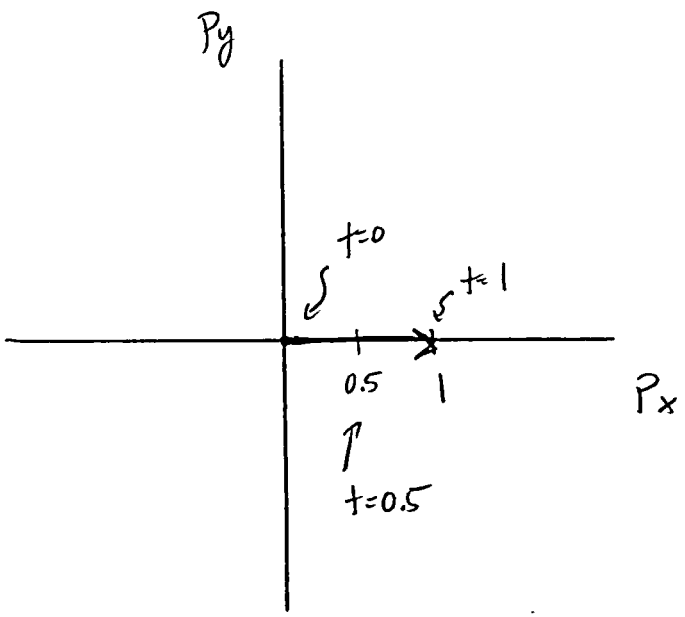
$$\dot{P}_x = V\cos\theta = 1\cos 0 = 1$$
$$\dot{P}_y = V\sin\theta = 1\sin 0 = 0$$

} $\dot{P}_x$ & $\dot{P}_y$ are constant because θ is *not* dependent on t

$$P_x(t) = P_x(0) + \int_0^t 1\,d\tau = 0 + t = t$$

$$P_y(t) = P_y(0) + \int_0^t 0\,d\tau = 0$$

$$P_x(t) = t \qquad t \in [0,1]$$
$$P_y(t) = 0$$



Problem 1A cont

Under the controls $u = \begin{bmatrix} v \\ \phi \end{bmatrix} = \begin{bmatrix} 1 \\ -45^\circ \end{bmatrix}$ Assuming 2.5 is in rad

$$\dot{\theta} = \frac{1}{0.4} \tan -45^\circ = -2.5$$

Therefore $\theta(t) = \theta(0) - 2.5t = -2.5t$

$$P_x(t) = P_x(0) + \int_0^t \dot{P}_x(\tau)\, d\tau = \int_0^t \cos(-2.5\tau)\, d\tau = \frac{1}{-2.5} \sin(-2.5\tau) \Big|_0^{\tau = t}$$

$$= \frac{1}{-2.5} \sin(-2.5t) + \frac{1}{2.5} \sin 0$$

$$P_x(t) = 0.4 \sin(2.5t)$$

$$P_y(t) = P_y(0) + \int_0^t \dot{P}_y(\tau)\, d\tau = \int_0^t \sin(-2.5\tau)\, d\tau$$

$$P_y(t) = 0.4 \cos(-2.5\tau) \Big|_0^{\tau = t} = 0.4 \left[\cos(-2.5t) - 1\right]$$

I used Matlab to plot this parameterized curve