Hint for the assignment on Kalman Filter.

Let $\Rightarrow$ $X = [x \quad y \quad \dot{x} \quad \dot{y}]^T$

$z = [x \quad y]^T$

Prediction Stage.

$X_t' = A X_{t-1} + w_t$ $\Leftarrow$ For tracking $u_t = 0$

$$A = \begin{bmatrix} 1 & 0 & T & 0 \\ 0 & 1 & 0 & T \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

w = white Guassian with 0 mean

$P_t' = A P_{t-1} A^T + Q.$

$$P = \begin{bmatrix} 10^2 & 0 & 0 & 0 \\ 0 & 10^2 & 0 & 0 \\ 0 & 0 & \left(\frac{V_m}{3}\right)^2 & 0 \\ 0 & 0 & 0 & \left(\frac{V_m}{3}\right)^2 \end{bmatrix}$$

V_m = max speed of target.

$$Q = Q_0 \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$