1. (a) $\begin{cases} x_{k+1} = A x_k \\ y_k = g(x_k) + D W_k \end{cases}$ $\qquad A = I_3$ $\qquad$ system

$\hat{x}_{k+1|k} = A \hat{x}_{k|k}$

$\hat{x}_{k+1|k+1} = \hat{x}_{k+1|k} + K_k (y_{k+1} - g(\hat{x}_{k+1|k}))$

$K_k = P_{k+1|k} C_{k+1}^T (C_{k+1} P_{k+1|k} C_{k+1}^T + R_{k+1})^{-1}$

$P_{k+1|k} = A_k P_{k|k} A_k^T + Q_k$

$P_{k+1|k+1} = P_{k+1|k} - K_k C_{k+1} P_{k+1|k}$

$$C_{k+1} = \frac{\partial g}{\partial x}\Big|_{\hat{x}_{k+1|k}} = \begin{bmatrix} \dfrac{\hat{x}_k - x_1}{\sqrt{(\hat{x}_k - x_1)^2 + (\hat{y}_k - y_1)^2}} & , & \dfrac{\hat{y}_k - y_1}{\sqrt{(\hat{x}_k - x_1)^2 + (\hat{y}_k - y_1)^2}} \\[2ex] \dfrac{\hat{x}_k - x_2}{\sqrt{(\hat{x}_k - x_2)^2 + (\hat{y}_k - y_2)^2}} & , & \dfrac{\hat{y}_k - y_2}{\sqrt{(\hat{x}_k - x_2)^2 + (\hat{y}_k - y_2)^2}} \\[2ex] \dfrac{\hat{x}_k - x_3}{\sqrt{(\hat{x}_k - x_3)^2 + (\hat{y}_k - y_3)^2}} & , & \dfrac{\hat{y}_k - y_3}{\sqrt{(\hat{x}_k - x_3)^2 + (\hat{y}_k - y_3)^2}} \end{bmatrix}$$