System Modeling, (Given):

- $\dot{x}_1(t) = V(t)\cos(\theta(t))$
- $\dot{y}_1(t) = V(t)\cos(\theta(t))$
- $\dot{\theta}(t) = \frac{V(t)}{B}\tan(\gamma(t))$

- B uncertain to $\pm 10\%$, r uncertain to $\pm 5\%$

- Modeling process noise as additive, and using a state vector of length 5, after descretizing using Forward Euler method our equations are,

$$S_k = \begin{bmatrix} x_k \\ y_k \\ \theta_k \\ \beta_k \\ r_k \end{bmatrix} = \begin{bmatrix} x_{k-1} + V_{k-1}\cos(\theta_{k-1})\Delta t \\ y_{k-1} + V_{k-1}\sin(\theta_{k-1})\Delta t \\ \theta_{k-1} + V_{k-1}\tan(\gamma_{k-1})\Delta t \\ \beta_{k-1} \\ r_{k-1} \end{bmatrix} + \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{bmatrix}_{k-1}$$

Where numeric values for process noise vector V are described in the report.

- For measurement modeling, $w(\cdot)$ was considered additive and used with the given descrete measurement model.

$$\therefore Z(k) = \begin{bmatrix} x(t_k) + \frac{1}{2}\beta\cos(\theta(t_k)) \\ y(t_k) + \frac{1}{2}\beta\sin(\theta(t_k)) \end{bmatrix} + \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}_k$$