Statistical Estimation	**Homework 7**
ASEN 5044 Fall 2018	**Due Date: November 8, 2018**
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Problem 1

Consider an aircraft moving in a plane with constant speed (the magnitude of the velocity vector) and turning with a constant angular rate. Such a model is often used by air traffic control tracking algorithms to describe aircraft executing coordinated turns. Given 2D inertial position variables $\xi(t)$, east position, and $\eta(t)$, north position. The equations of motion are

$$\ddot{\xi} = -\Omega\dot{\eta}$$
$$\ddot{\eta} = \Omega\dot{\eta}$$

where Ω is the constant angular rate, such that $\Omega > 0$ implies a counterclockwise turn. Using the state representation $x(t) = [\xi, \dot{\xi}, \eta, \dot{\eta}]^T$, it can be shown that

$$e^{A\Delta t} = \begin{bmatrix} 1 & \frac{\sin(\Omega\Delta t)}{\Omega} & 0 & -\frac{1-\cos(\Omega\Delta t)}{\Omega} \\ 0 & \cos(\Omega\Delta t) & 0 & -\sin(\Omega\Delta t) \\ 0 & \frac{1-\cos(\Omega\Delta t)}{\Omega} & 1 & \frac{\sin(\Omega\Delta t)}{\Omega} \\ 0 & \sin(\Omega\Delta t) & 0 & \cos(\Omega\Delta t) \end{bmatrix}$$

Where A is the CT LTI state matrix for the system.