Problem 1:

Consider a plant described by

$$\dot{\mathbf{x}} = \begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

a. Find out if the system is stable.
b. Find out if the system is controllable.
c. Use direct coefficients matching method to find the K that shifts the poles to -1$\pm$j2.
d. Apply Ackermann's formula to find the same K in part c.
e. Repeat part c and part d in Matlab by using function *place* and *acker*.
f. Simulate time domain solution of the system before and after shifting the poles and explain. The input is unit step function.

Problem 2:

Consider a plant described by

$$\underline{\dot{x}} = \begin{bmatrix} 1 & 1 & -2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \underline{x} + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u \quad y = \begin{bmatrix} 2 & 0 & 0 \end{bmatrix} \underline{x}$$

a. Find out if the system is stable.
b. Find out if the system is controllable.
c. Use direct coefficients matching method to find the K so that the resulting system has eigenvalues -2 and -1$\pm$j1
d. Apply Ackermann's formula to find the same K in part c.
e. Repeat part c and part d in Matlab by using function *place* and *acker*.
f. Simulate time domain solution of the system before and after shifting the poles and explain. The input is unit step function.