1. Consider this subset of $\mathbb{R}^3$.

$$S_1 = \{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \mid x - y - z = 0 \}$$

a) List three elements and three non-elements.

b) Show that the set is closed under addition (with the standard operation).

c) Show that it is closed under scalar multiplication.

2. Consider this subset of $\mathbb{R}^3$.

$$S_2 = \{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \mid x - y - z = 3 \}$$

a) List three elements and three non-elements.

b) Show that it is not closed under addition.

c) Show that it is not closed under scalar multiplication.

3. Consider this subset of $\mathcal{M}_{2\times 2}$.

$$S_3 = \{ \begin{pmatrix} a & b \\ c & 0 \end{pmatrix} \in \mathcal{M}_{2\times 2} \mid a + 2b + c = 0 \}$$

a) List three elements and three non-elements.

b) Show that it is closed under addition (with the standard operation).

c) Show that it is closed under scalar multiplication.

4. Consider this subset of $\mathcal{P}_2$.

$$S_4 = \{ px^2 + qx + r \in \mathcal{P}_2 \mid p + q = 0, r \in \mathbb{R} \}$$

a) List three elements and three non-elements.

b) Show that it is closed under addition (with the standard operation).

c) Show that it is closed under scalar multiplication.