1.) Let $S, T \in \Omega(\mathbb{R}^n)$ be the operators defined by $S(x_1, x_2, \ldots, x_n) = (0, x_1, \ldots, x_{n-1})$, $T(x_1, x_2, \ldots, x_n) = (x_2, \ldots, x_n, 0)$
Find a bases $E = \{e_1, e_2, \ldots, e_n\}$ and $F = \{f_1, f_2, \ldots, f_n\}$ such that $[S]_E = [T]_F$

2.) Let $T \in \Omega(\mathbb{R}^n)$ with minimum polynomial $m(\lambda)$ that has linear factors. Prove that $T$ is diagonalizable.

3.) Let $T \in \Omega(\mathbb{R}^n)$ and define $U = \ker(T^i)$ and $W = \ker(T^{i+1})$. Then
   a.) $U \subseteq W$
   b.) $T(W) \subseteq U$

4.) Let $T \in \Omega(\mathbb{R}^n)$ be the operator defined by:
   $T(x_1, x_2, \ldots, x_n) = (s, s, \ldots, s)$ where $s = \Sigma x_i$
   a.) Find a matrix which represents $T$
   b.) Find the characteristic polynomial of $T$.
   c.) Find the minimal polynomial of $T$.
   d.) Find the Jordan Form for $T$.

5.) Let $S, T : \mathbb{C}^3 \rightarrow \mathbb{C}^3$ be given by:
   $S(x, y, z) = (2x + y, 2y + z, 2z)$ $T(x, y, z) = (2x + y, 2y, 2z)$
   a.) Find a matrix which represents $S, T$
   b.) Find the eigenvalues of $S, T$.
   c.) Find the characteristic polynomial of $S, T$.
   d.) Find the minimal polynomial of $S, T$.
   e.) Find the Jordan Form of $S, T$.

6.) Give examples of operators on $\mathbb{C}^4$
   a.) whose minimal polynomial is $\lambda(\lambda - 1)^2$.
   b.) whose minimal polynomial is equal to it's characteristic polynomial is equal to $\lambda(\lambda - 1)^2(\lambda - 3)$ .
   c.) whose minimal polynomial is $\lambda(\lambda-1)(\lambda-3)$ and characteristic polynomial is $\lambda(\lambda-1)^2(\lambda-3)$