1. Let $w$ be a subspace of $\mathbb{R}^4$ generated by the vectors $(1, -2, 5, -3)$, $(2, 3, 1, -4)$, and $(3, 8, -3, -5)$. Find a basis and dimension of $w$

2. Show whether $w = \{(x, y) / y \leq x^2\}$ is a subspace of $\mathbb{R}^2$

3. Show whether the differential operator defined below is a linear transformation or not.
   $T x(t) = x'(t) = \frac{d}{dt}x(t)$

4. Given the matrix
   $$A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 4 & 1 & 4 \\ 3 & 6 & 3 & 9 \end{bmatrix}$$
   Find a lower triangular $L$ and an upper triangular $U$ so that $A = LU$