1. Let $a$ be an element of a group $G$. Give, with proof, the generator of the subgroup $\langle a^m \rangle \cap \langle a^n \rangle$.

2. Prove or disprove: $\text{SL}_2(\mathbb{Z}_2)$ cyclic.

3. Solve for $x$. Explain your work and express your answer in the form of $a + bi$ for $a, b \in \mathbb{R}$.

   $$-ix^2 + 2x + i + 1 = 0.$$