1. (30 points) Consider the permutation:

\[ \sigma = (174)(246)(145) \]

i) Find a decomposition of \( \sigma \) into a product of disjoint cycles.

ii) Find a decomposition of \( \sigma \) into a product of transpositions.

iii) How unique are these two decompositions?
2. (30 points)
   i) Determine the invertible elements in $\mathbb{Z}_{18}$.
   ii) Find all integers $x$ that satisfy the equation $5x \equiv 8 \pmod{18}$. 


3. (20 points) Let \( R \subset \mathbb{R}^2 \) be a triangle and denote by \( K \) its group of symmetries. Show that \( K \) is \textbf{not} isomorphic to the group \((\mathbb{Z}_6, +)\).
4. (20 points) Show that the set of affine transformations $T : \mathbb{R}^n \to \mathbb{R}^n$ of the form:

$$T(\vec{x}) = A\vec{x} + \vec{b},$$

where $A$ is a $n \times n$ matrix with $\det A \neq 0$ and $\vec{b} \in \mathbb{R}^n$ is a vector, is a group with binary operation composition of transformations.