

1. Consider the relation \sim on \mathbb{Z} defined by $x \sim y \Leftrightarrow x - y \equiv_5 3$. Determine whether \sim is an equivalence relation.

2. Let $S = \{a, b, c, d, e\}$, and let $\sim = \{(a, a), (a, b), (b, a), (b, b), (c, c), (d, d), (d, e), (e, d), (e, e)\}$.

(a) Give the equivalence classes of \sim .

(b) Give the partition associated with \sim .

3. Let S be a set and Π a partition of S . Let \sim be a relation on S defined by $a \sim b \Leftrightarrow \exists P \in \Pi$ for which $a, b \in P$.

(a) Show \sim is a reflexive relation.

(b) Show \sim is a symmetric relation.

(c) Show \sim is a transitive relation.

4. Regarding the function $f : A \rightarrow B$ as a subset of $A \times B$,
- (a) State the definition of f being injective.

- (b) State the definition of f being surjective.

5. Call two vertices v_1 and v_2 in a graph G **evenly connected** iff the shortest walk from v_1 to v_2 has even length (where the length of a walk is the number of edges in that walk). Determine whether the relation of being evenly connected is reflexive, symmetric, and transitive.