Pledge: *I pledge my honor that I have abided by the Stevens Honor System.* -Eric Altenburg

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1: Prove that each of the following relations is an equivalence relation. Then describe the corresponding equivalence classes, e.g. by giving a geometric description.

(The relation R defined on $\mathbb{R}^2$ by $((a,b),(c,d)) \in R$ if $|a|+|b|=|c|+|d|$.)

(The relation S defined on the set of positive rational numbers $\mathbb{Q}_{>0}$ by $(a,b) \in S$ if $\frac{a}{b} = 2^n$ for some $n \in \mathbb{Z}$.)

2: Let R and S be equivalence relations on a set A. Prove or disprove the following statements.

(The relation $R \cup S$ is an equivalence relation on A.)

(The relation $R \cap S$ is an equivalence relation on A.)

3: The set of integers *modulo* n, where $n > 1$ is a natural number, is denoted $\mathbb{Z}/n\mathbb{Z}$ and is defined as the set of equivalence classes under the equivalence relation on $\mathbb{Z}$ of being congruent modulo n. Prove that is it possible to define addition and multiplication operations on $\mathbb{Z}/n\mathbb{Z}$ via the formulas $[a]+[b]=[a+b]$ and $[a]\cdot[b]=[a\cdot b]$, respectively.
