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Generalization of two notions in group theory-associativity and order

In this talk, we generalize two group-theoretic ideas as follows.

i) We formalize and prove "the most general setting" to define associativity of a binary function and generalized associativity, i.e. "inserting parentheses in any manner".

ii) By definition, the order of an element is either a positive integer or infinite. Using transfinite recursion, we generalize the notion to the class of ordinals for topological groups. Arithmetical and group-theoretic properties of such generalization are studied. We also discuss examples that lead to further questions.