

A. Give generators and relations for the symmetry groups of

- a. a triangle: label vertices A,B,C, counterclockwise.
- b. a square
- c. a pentagon
- d. A circular wheel with five equally spaced spokes, and an inside rim different from the outside.
- e. An infinite railroad track with equally spaced and equal ties. (Compare with #16 p. 38 of text, about the symmetries of an infinite row of equally spaced H's. Hint: choose a labeling system. Which motions fix a given vertex?)

B. Show the following (a-c). or find the following (d-f)

- a. Let S be a set with an associative operation, and an identity e . Show that a right inverse A of an element B in S and a left inverse C of B , must be the same. The hypotheses imply that $BA=e$ and $CB=e$.
- b. If A,B are in a group, and have inverses, C,D , respectively, what is the inverse of AB ?
- c. The set S of rational numbers mod 1 is an Abelian group under addition? What relation does this group S have with the rotations of a circle?
- d. What are the symmetries (distance-preserving maps) of a circle? (This doesn't ask for the group structure, but any remarks on the symmetry group are welcome).
- e,f. Make up an easy, then a harder problem of describing the symmetry group of some object or pattern.