

MAT 150A, Fall 2023

Homework 8

Due before 2:10 on Friday, December 8

Please write the homework solutions in connected sentences and explain your work. Mark the answers to each question. Scan or take pictures of your homework and upload it to Gradescope before due time.

1. (20 points) A brick has height 1, width 2 and length 3. Its group of isometries acts on faces, vertices and edges of the brick.
 - a) Find the orbit and stabilizer for each face of the brick.
 - b) Find the orbit and stabilizer for each vertex of the brick.
 - c) Find the orbit and stabilizer for each edge of the brick.
 - d) Use Counting Formula to find the size of the isometry group.
2. (10 points) Consider the action of the group S_7 on the set of 3-element subsets of $\{1, 2, 3, 4, 5, 6, 7\}$.
 - a) Find the stabilizer of the subset $\{1, 2, 3\}$.
 - b) Describe the orbit of $\{1, 2, 3\}$. and use Counting Formula to compute the size of this orbit.
3. (10 points) A soccer ball (see picture¹) has 12 black pentagons and 20 white hexagons. Its group of isometries acts on the set of faces.
 - a) Find the orbit and stabilizer of each face
 - b) Use Counting Formula to compute the size of the isometry group.



¹Picture credit: Wikipedia