

Study Guide for Exam #1

This Study Guide is accompanied by a GeoGebra book. Make sure you look at the problems there, too:

<http://www.geogebratube.org/student/bjD29c4et#>

The exam will take place in the computer lab. You will submit (1) a test sheet with your answers (handwriting is fine) and (2) ggb files. You will submit the file(s) by e-mail.

1. Isometries.
 - a. You should be comfortable finding images of given originals using various methods: Dot paper, Transparencies, Computer Technology.
 - b. You should be able to identify isometries if given an original and its image.
 - c. You should be able to apply isometries in problem solving: Thirsty horse problem and billiard problems with explanations why the path you drew is the shortest possible.
2. Composition of isometries
 - a. Explain why a composition of seven line reflections cannot yield a rotation.
 - b. Explain what will result as a composition of two reflections with
 - i. intersecting lines
 - ii. parallel lines
 - c. Prove that angle of the resulting rotation (distance of the resulting translation) is twice the angle (distance) between the lines. See the GGB book.
 - d. Explain why we typically determine a glide reflection by a line of reflection and translation vector that is *parallel* to it.
 - i. If the vector is not parallel to the line, can the resulting isometry be a glide reflection?
 - ii. Can composition of a line reflection and translation ever be something other than a glide reflection?
3. Rosette Symmetry
 - a. List all symmetries of a square. Equilateral triangle. Regular pentagon. Parallelogram that is not a rhombus.
 - b. You should be able to identify symmetries of given objects.
 - c. You should be able to generate a symmetrical pattern based on symmetry and generator. Make sure you know how to do it using paper cutting, Mira, mirrors and dynamic geometry.
 - i. Generate D_4 , D_6 , ...symmetry pattern by paper cutting.
 - ii. Generate D_3 symmetry pattern by using the Mira device.
 - iii. Generate D_7 pattern from a generator by using the technology (see GGB book).
 - d. Is there a symmetrical pattern with a D symmetry and no C symmetry? Explain or show an example.
 - e. Is there a symmetrical pattern with a C symmetry and no D symmetry? Explain or show an example.
 - f. You should be able to generate a “kaleidoscope” geogebra file for a given symmetry:
 - i. D_5

ii. C_5

4. Frieze symmetry

- a. Explain why a translation cannot be a symmetry of a finite pattern (in other words, explain why all patterns that have translation as their symmetry are infinite).
- b. You should be able to identify symmetry of a given frieze pattern. You don't have to memorize all the groups – list similar to one on Wikipedia will be available to you.
- c. You should be able to generate a “kaleidoscope” geogebra file for a given frieze symmetry

The following questions will be included in Exam 2 (you don't have to worry about them when preparing for Exam #1).

5. Wallpaper symmetry

- a. You should be able to identify symmetry of a given wallpaper pattern. You don't have to memorize all the groups – an identification key similar to one on Wikipedia will be available to you.
 - i. Examples of wallpaper patterns that you should be able to analyze:

http://euler.slu.edu/escher/index.php/Wallpaper_Patterns

- b. You should be able to generate a “kaleidoscope” geogebra file for a wallpaper patterns that we did in class.