MA 111 Review for Exam 3

   Exam 3 (given in class on Wednesday, October 14) will cover Unit 3: The Mathematics of Symmetry.

   Can you work each homework and quiz problem *correctly* and *quickly*, providing explanations and justifications, without looking at the textbook?
   Have you carefully studied the material in Chapter 11 of the text?
   Have you carefully studied the slides on the website?
   You should be familiar with the following key ideas:

1. Understand how to carry out each of the following four motions:

    - Reflection

    - Rotation

    - Translation

    - Glide reflection

2. Know what it means to be a proper or improper motion, and be able to characterize the four motions as either proper or improper.

3. Know what a fixed point is and be able to characterize the four motions by the number of fixed points each one has.

4. Know how many point-image pairs are needed to completely determine each motion.

5. Given only information about a point(s) and its image(s), be able to construct the other identifying features of a motion. For instance, given one point-image pair for a reflection, be able to find the axis of reflection.

6. Be able to identify the symmetry type of a finite object as either D_n or Z_n.

7. Draw examples of finite objects with a given symmetry type.

8. Understand the types of symmetries in border patterns and be able to use the chart to determine which of the seven symmetry types a given pattern possesses.

9. Read sections 11.2 through 11.7 in the textbook, review homework problems, and try the odd-numbered problems whose answers are in the back of the book.

Practice Problems

1. For practice in carrying out the four motions, see exercises 1, 3, 11, 19, 21, and 27 in the textbook.

2. For practice in using point-image pairs to find the identifying features of a motion, see exercises 5, 7, 15, 17, 23, 25, 29, and 31.

3. In each of the following cases, use the properties to decide if the motion is a reflection, a rotation, a translation, or a glide reflection.

   (a) The motion is improper and has no fixed points.

   (b) The motion is proper and has no fixed points.

   (c) The motion is improper, and when the same motion is applied twice, we get the identity motion.

   (d) The motion is proper and has one fixed point.

   (e) The motion is proper, and when the same motion is applied twice, we get the identity motion.

4. For practice in identifying the symmetry types of finite objects, see exercises 35, 37, and 43.

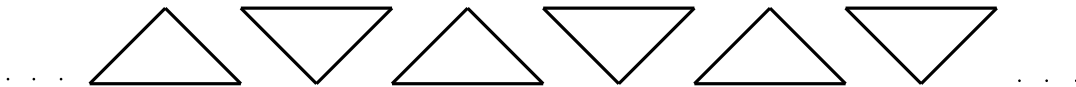5. Identify the symmetry types of the following images:

(a)

(c)

(b)

(d)

(e)

(f)
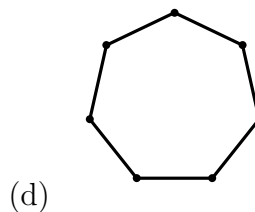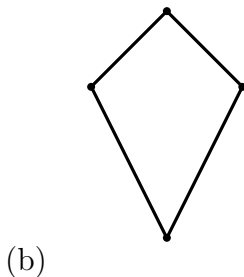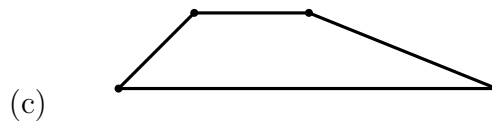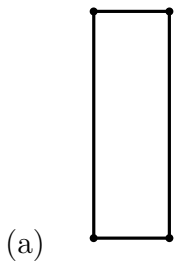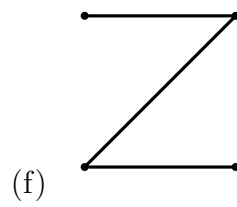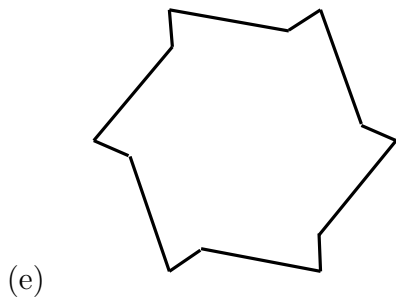
6. Draw an example of a letter which has the symmetry type...

   (a) D_1

   (b) Z_1

   (c) Z_2

   (d) D_2

7. Explain why a circle has symmetry type D_∞.

8. What kinds of symmetry does the following border pattern contain?

   . . . △▽△▽△▽ . . .

   Does it have...

   (a) a horizontal reflection?

   (b) a vertical reflection?

   (c) a rotation?

   (d) a translation?

   (e) a glide reflection?

   (f) What is its symmetry type?