

Sample Test Problems for Chapter 8

- For each picture in Figure 1, describe a *single* transformation that will take shape A to shape B. Describe each transformation *in detail* (you may draw on the pictures to help you).

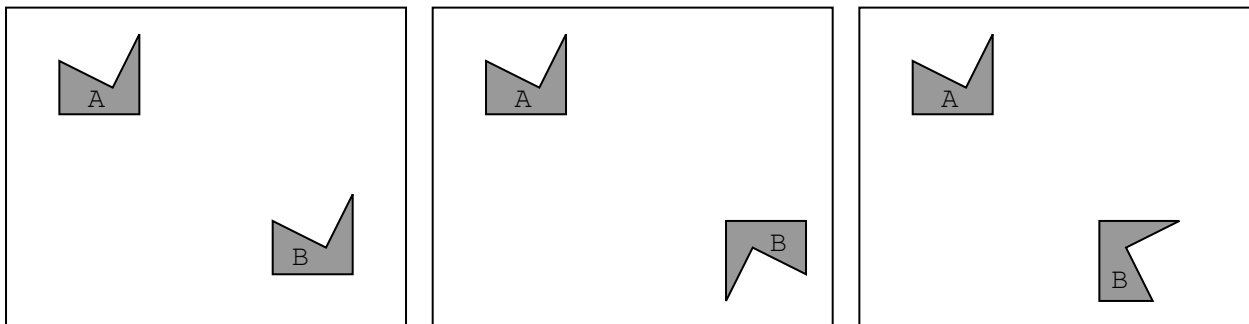


Figure 1: Three Pictures

- For each picture in Figure 2, describe a *single* transformation that will take shape A to shape B. Describe each transformation as precisely as you can.

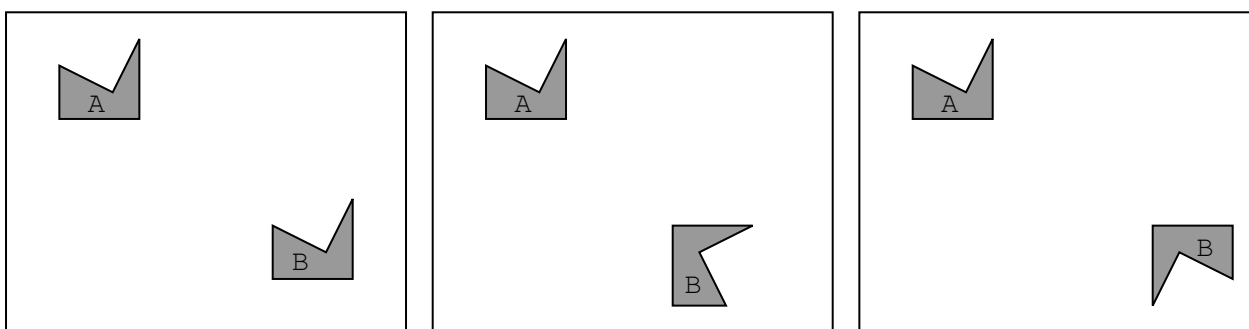


Figure 2: Three Pictures

- For each of the three pictures in Figure 3, describe a *single* transformation that takes shape A to shape B. Draw marks on the pictures to help you describe the transformations as precisely as possible.
- Draw the result of reflecting the shaded shape in Figure 4 across the heavy line.
- Draw the result of translating the shaded shape in Figure 5 in the direction and by the distance indicated by the arrow.
- Draw the result of rotating the shaded shape in Figure 6 90° counterclockwise around the indicated point.

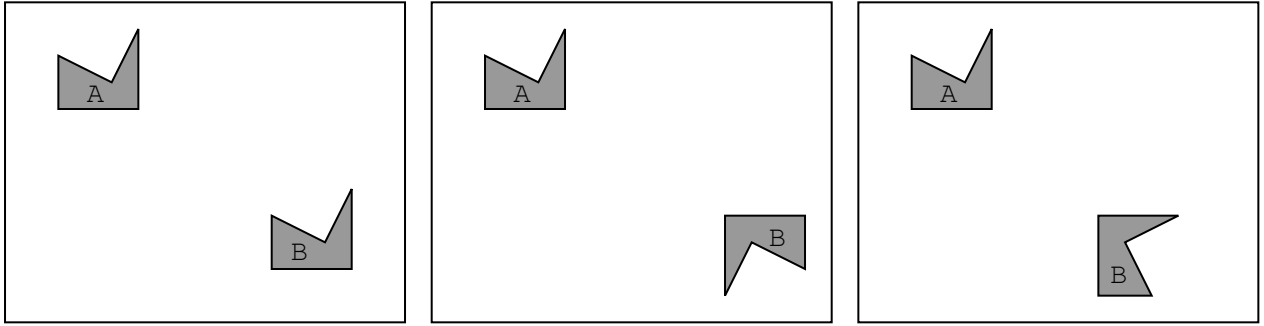


Figure 3: Three Pictures

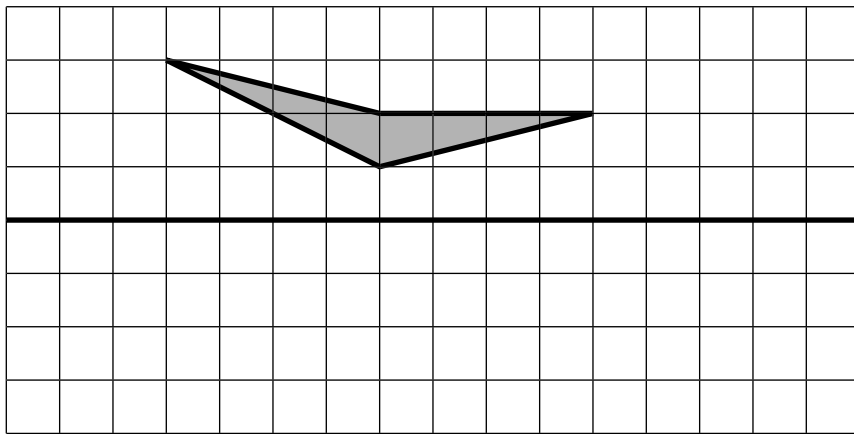


Figure 4: Draw the Result of Reflecting Across the Heavy Line

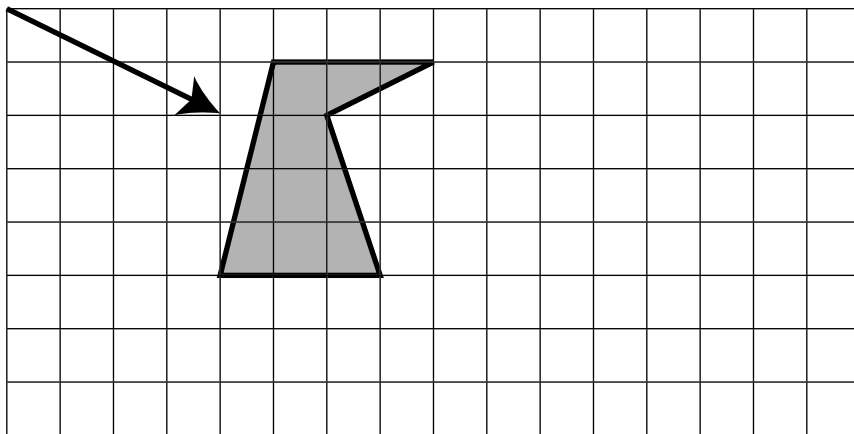


Figure 5: Draw the Result of Translating

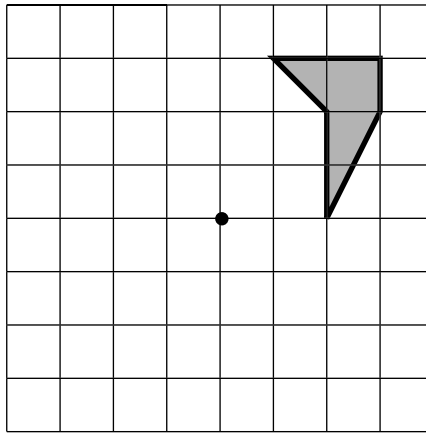


Figure 6: Draw the Result of Rotating 90° Counterclockwise

7. Draw a design that is made with copies of the curlicue in Figure 7 (and its reflection) so that the *design as a whole* has both 3-fold rotation symmetry *and* reflection symmetry. Neither artistry nor an explanation is needed.

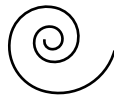


Figure 7: A Curlicue

8. Draw a design that is made out of (approximate) copies of the curlicue shown in Figure 7 (and its reflection) and that has 4-fold rotation symmetry *as well as* reflection symmetry. (Artistry is not required—a rough sketch will do as long as it shows the desired features clearly.)
9. Draw a design that is made out of copies of the shaded shape in Figure 8 and has 4-fold rotation symmetry but no reflection symmetry.

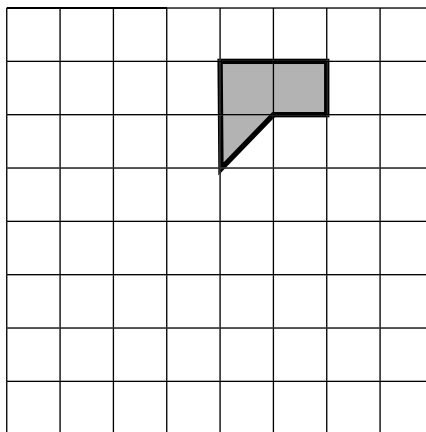


Figure 8: Create a Symmetrical Design

10. Draw a design that is made out of copies of the shaded shape in Figure 8 and has both 4-fold rotation symmetry and reflection symmetry.
11. What symmetries does the design in Figure 9 have? Describe each symmetry as precisely as you can. (Consider the design as a whole.)

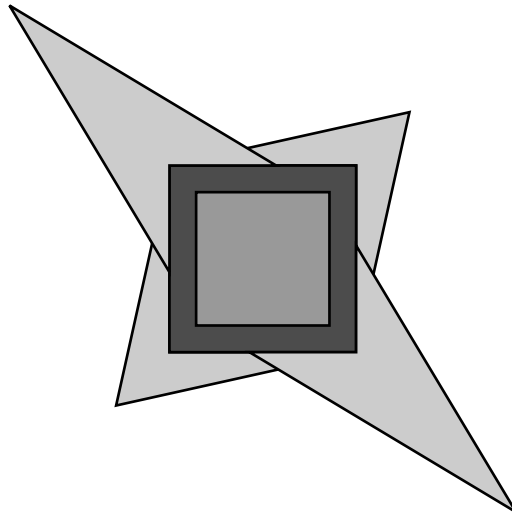


Figure 9: A Design

12. What kinds of symmetry does the design in Figure 10 have? Describe each kind of symmetry as precisely as you can.

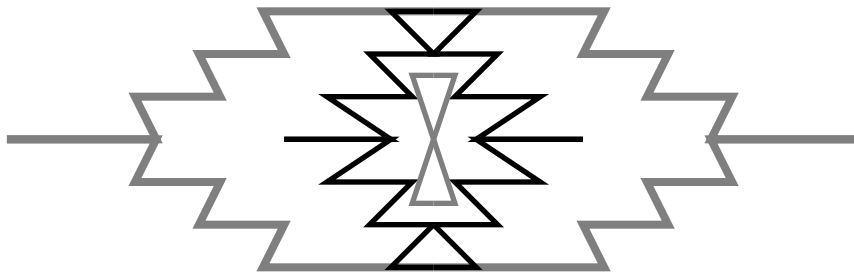


Figure 10: A Design

13. Explain clearly the distinction between the concept of translation and the concept of translation symmetry. How are these two concepts related?
14. Explain clearly the distinction between the concept of rotation and the concept of rotation symmetry. How are these two concepts related?
15. Explain clearly the distinction between the (mathematical) concept of reflection and the concept of reflection symmetry. How are these two concepts related?
16. Write a short essay on the relationship between the concept of **translation** and the concept of **translation symmetry**. Your essay will be graded on its thoroughness, accuracy, and clarity of expression.

17. Ada, Bada and Cada are three cities. Bada is 15 miles from Ada, Cada is 20 miles from Bada, and Ada is 25 miles from Cada. There are straight line roads between Ada and Bada, Ada and Cada, and Bada and Cada.
- Draw a careful and precise map showing Ada, Bada, and Cada and the roads between them, using a scale of 10 miles = 1 inch. Describe how to use a compass to make a precise drawing.
 - If you were to draw another map, or if you were to compare your map to a classmate's, how would they compare? In what ways might the maps differ, in what ways would they be the same? Which criterion for triangle congruence is most relevant to these questions?
18. Suppose you make a triangle by threading three pieces of straw onto a string and tying the ends of the string together to make a loop. Similarly, suppose you make a quadrilateral by threading four pieces of straw onto a string and tying a loop. Describe the structural difference between the triangle and the quadrilateral (*other than* the fact that the triangle is made out of three pieces of straw and the quadrilateral is made out of four), and explain how this structural difference is related to the concept of congruence.
19. Annemarie designed her own flag on a rectangle that is 4 inches by 7 inches. Now Annemarie wants to make a scaled up version of her flag in such a way that the 4 inch side becomes 12 inches long, and so that the larger flag is similar to the original flag. Annemarie figures that because the 4 inch side will become 8 inches longer in the enlarged flag (because $4 + 8 = 12$), she should also make the 7 inch side 8 inches longer in the enlarged flag. Therefore Annemarie figures that the enlarged flag should be 12 inches by 15 inches. Is Annemarie's reasoning valid? Explain.
20. A scaling problem: Jessica wants to make a scaled up version of a picture that is on a postcard. The postcard is 4 inches wide and 6 inches long. If Jessica wants to make the scaled up version 10 inches wide, then how long should she make it?
- Determine the answer to the scaling problem in *two ways other than by setting up a proportion*. In each case, explain why the method makes sense as if you were explaining it to a child who understands about multiplication and division (but who does not know about setting up proportions).
21. Suppose you are looking down a road and you see a person ahead of you. You hold out your arm and "sight" the person with your thumb, finding that the person appears to be as tall as your thumb is long. Let's say that your thumb is 2 inches long, and that the distance from your sighting eye to your thumb is 22 inches. If the person is 6 feet tall, then how far away are you from the person? Solve this problem using either the *scale factor method* or the *relative sizes method*, and say clearly what the *idea* behind the method is. In other words, explain why it makes sense to solve the problem the way you do.
22. A painting that is 120 inches by 150 inches will be reproduced on a poster. Suppose that on the poster, the 120 inch side will become 20 inches long. Determine how long the 150 inch side will become on the poster. Calculate your answer in *three ways*: by the *scale factor method*, by the *relative sizes method*, and by the *setting up a proportion* method. In each case, show your work.

23. Ms. Nice's 5th grade class wants to figure out how tall the school flagpole is. On a sunny day, the class goes outside and measures that the shadow of the flagpole is about 21 feet long. At the same time, Juan's shadow is 3 feet, 4 inches long. Juan is 4 feet, 3 inches tall.
- (a) Determine the (approximate) height of the flagpole using a method that the children in Ms. Nice's class could find plausible. The children know about multiplication and division, but they don't know any more advanced mathematics, such as setting up proportions. The class is allowed to use calculators when multiplying and dividing decimals or fractions.
 - (b) Now add details to your explanation in part (a) in order to make your explanation more thorough for someone who has a more advanced knowledge of mathematics. Draw a picture showing that the flagpole problem involves similar triangles. Explain why the triangles must be similar.