

SHAPES IN MOTION

Performance Standard 9A.H

Move a given shape through a series of transformations, determine another single transformation that would have resulted in the same initial pre-image and final image, and analyze whether those motions would produce equivalent images with other starting figures accordingly:

- *Mathematical knowledge:* Know how to analyze the results of a combination of reflections, rotations, and translations of a figure, and determine alternate motions that could produce the same result.
- *Strategic knowledge:* Use appropriate strategies to solve the problem.
- *Explanation:* Explain completely and clearly what was done and why it was done.

Procedures

1. *In order to demonstrate and apply geometric concepts involving points, lines and planes (9A)*, students should experience sufficient learning opportunities to develop the following:
 - Analyze the results of a combination of reflections, rotations, and translations of a figure, and determine alternate motions that could produce the same result.Note: Students should be familiar with transformations.
2. Provide each student a copy of the “Shapes in Motion” task sheet and the rubric. Have students review the task and how the rubric will be used to evaluate it. Teacher should specify which color pencil to use 1st, 2nd, 3rd to ease scoring. Straightedges and protractors may be used, but are not necessary.
3. Have the students work individually to solve the problem. (Do not help the students or guide their thinking.)
4. Evaluate each student’s work using the rubric and its guide to determine the performance level. Give each student a score in each of the three categories, scoring each part of the problem separately as follows:
 - Part A: Really addresses the students’ ability to complete transformations. This is a task that is expected prior to Stage H, but must be mastered prior to being able to complete part B, which addresses Stage H expectations.
 - Part B: Gregor is confused by the fact that the shape would end up appearing to be in the same location, but the actual vertices are not in the same positions. (The symmetry of the figure and the original transformations have produced this effect.) Students should identify this as problematic. 1) The similarities are the shape of the figure and its location. The differences are where each vertex’ image is located. 2) This is not really the same result. 3) The same result cannot be accomplished in a single motion because the reflection will change the order of the vertices as you go around the figure clockwise or counter-clockwise. The only way they can get back to the original orientation is to reflect the object a second time. 4) Several other sets of motions are possible that will result in the same final image. Make sure their descriptions of the motions are complete, and accurate, and that the students’ drawings accurately depict their written descriptions of the motions.

The explanations should include how they found these answers, as well as why these answers are correct.

Examples of Student Work follow

Time Requirements

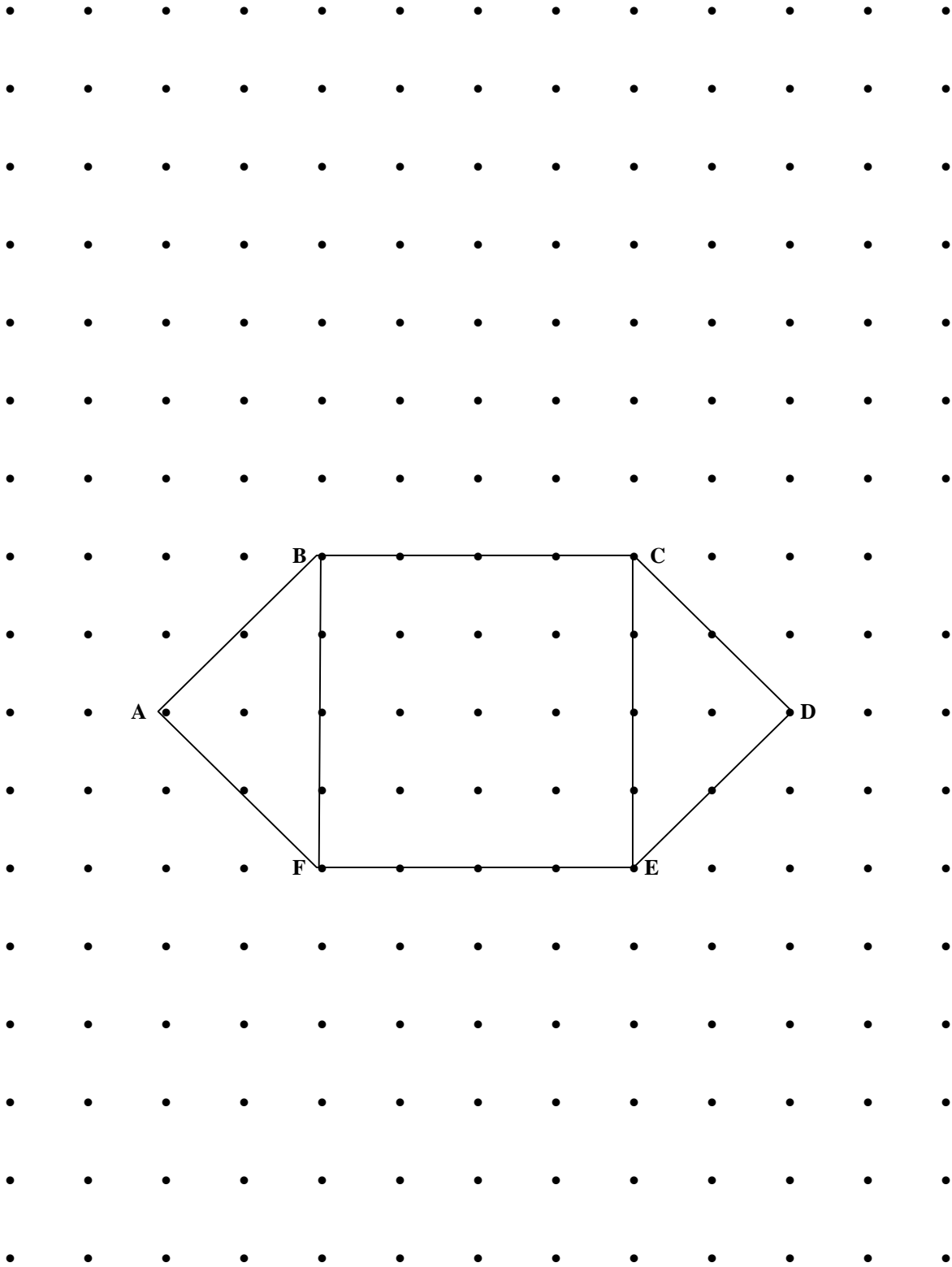
- One class period

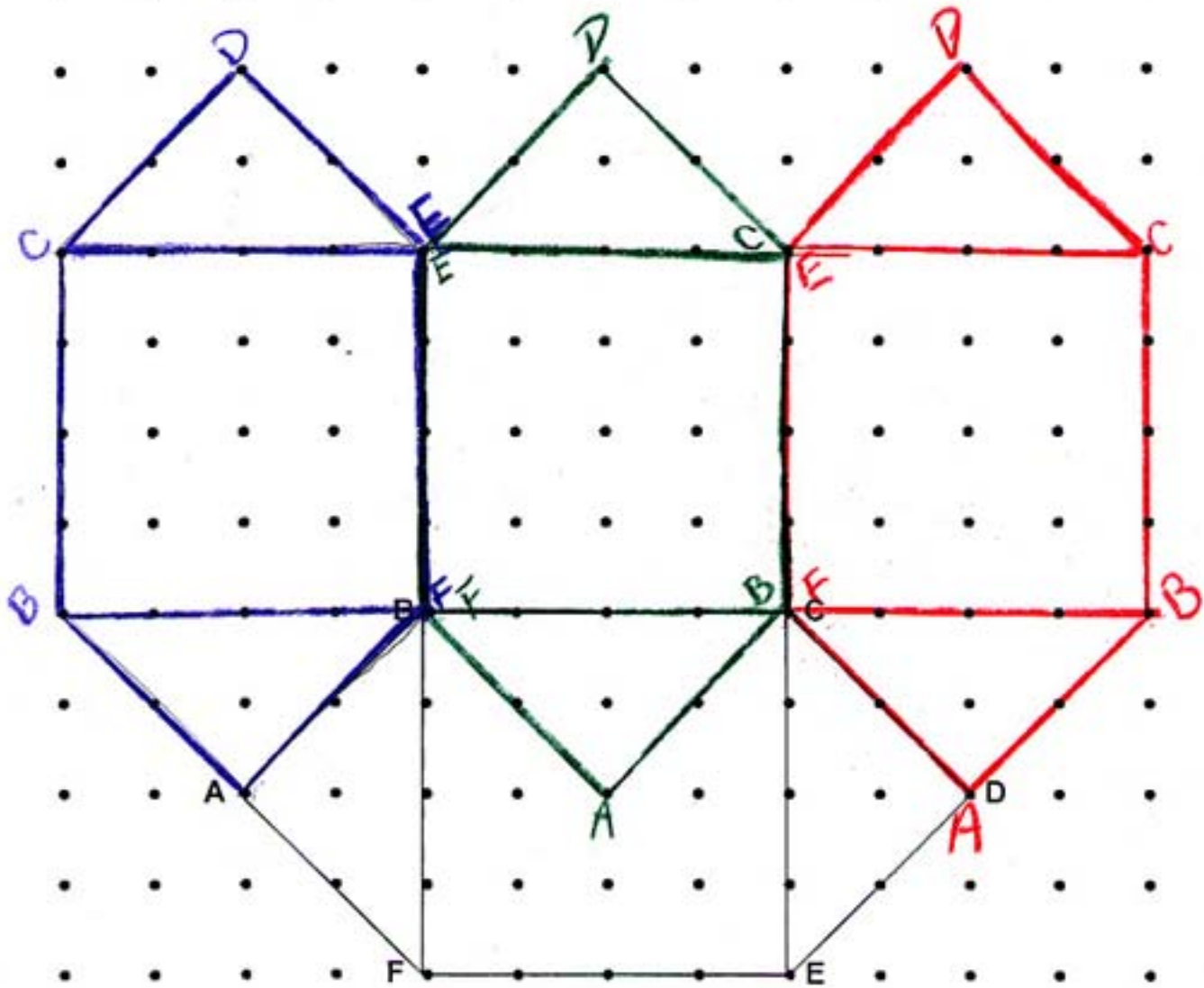
Resources

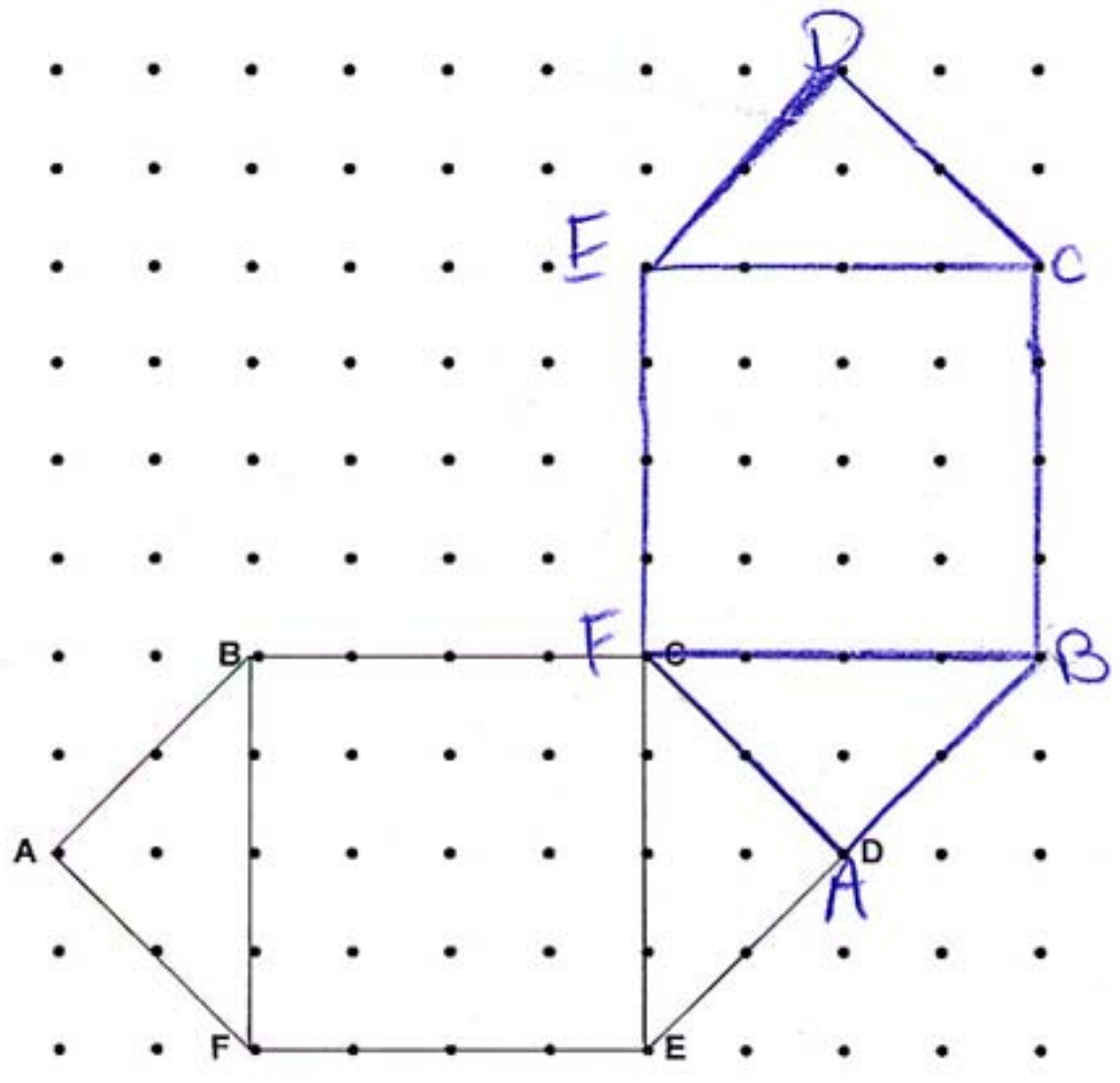
- Copies of the “Shapes in Motion” task sheets
- Protractors and straightedges should be available for use in transformations.
- Students may need a couple of sheets of blank paper or extra copies of the grid paper diagram if they make errors.
- Mathematics Rubric

Shapes in Motion

- A. On the attached sheet of dot paper, you will find a hexagon with two diagonals drawn. The hexagon has its vertices labeled A, B, C, D, E, & F. Use the dot paper and the drawing to perform the following transformations:
- 1) Draw an image of figure ABCDEF after a counterclockwise rotation of 90° centered at the point A. Clearly label your pre-image and image. Draw the image using a colored pencil or pen.
 - 2) Take this image and reflect it about the line containing the original segment BF. Draw this new image in another color of pencil or pen.
 - 3) Finally take the latest figure and translate it 4 units horizontally. Draw this final image in a third color.
- B. One of your classmates, Gregor, claims there are several other single transformations you could have used instead to get the same image. One of the transformations that Gregor suggested was to rotate the original figure 90° clockwise around point D.
- 1) Compare the results of the transformation Gregor has suggested with the one you performed in part A. How are they similar? How are they different?
 - 2) Is this really the same result? Why or why not?
 - 3) Can the same result be obtained from a single motion? Why or why not?
 - 4) Find another **set** of transformations that would produce the exact same image as the given set of transformations? Write the steps below and use the second sheet of dot paper to draw the steps in your proposed set of transformations.







Name _____

Date 4-27-01

Shapes in Motion.

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B. One of your classmates, Gregor, claims there are several other single transformations you could have used instead to get the same image. One of the transformation that Gregor suggested was to rotate the original figure 90° clockwise around point D.

- 1) Compare the results of the transformation Gregor has suggested, with the one you performed in part A. How are they similar, how are they different?

His figure ends up looking the same as mine. The difference is that the points aren't labeled the same, his point D is my point A.

- 2) Is this really the same result? Why or why not?

No, because all of the points are opposite of each other.

- 3) Can the same result be obtained from a single motion? Why or why not?

No, because you have to rotate it once to get the same points labeled.

- 4) Find another set of transformations that would produce the exact same image as the given set of transformations? Write the steps below and use the second sheet of dot paper to draw the steps in your proposed set of transformations.

1) translate figure ABCDEF 0 units vertically
2) rotate new image 90° counterclockwise
3) translate the last drawn image vertically 1 unit

