

SHAPES IN MOTION USING AUTO CADD

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.

Individuals employed in drafting occupations often find it necessary to move, rotate and mirror an image, as well as change properties as they complete a drawing using Computer Aided Drafting (CAD). In addition, the process requires the establishment of a grid and snap settings. This assessment aligns with CAD standards within the Architectural Drafting Cluster and Mechanical Drafting Cluster occupational skill standards. It also addresses the International Technology Education Association (ITEA) Standards #3 (Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study) and #8 (Students will develop an understanding of the attributes of design.)

Note: Students should be familiar with transformations and basic CADD drawing commands.

2. Provide each student a copy of the “Shapes in Motion Using Auto CADD” task sheet and the rubric. Have students review the task and how the rubric will be used to evaluate it. The teacher should specify which colors to assign to the lines 1st, 2nd, 3rd to ease scoring. Appropriate CAD drawing commands are to be utilized.
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

- [Meets](#)
- [Exceeds](#)

Time Requirements

- One class period

Resources

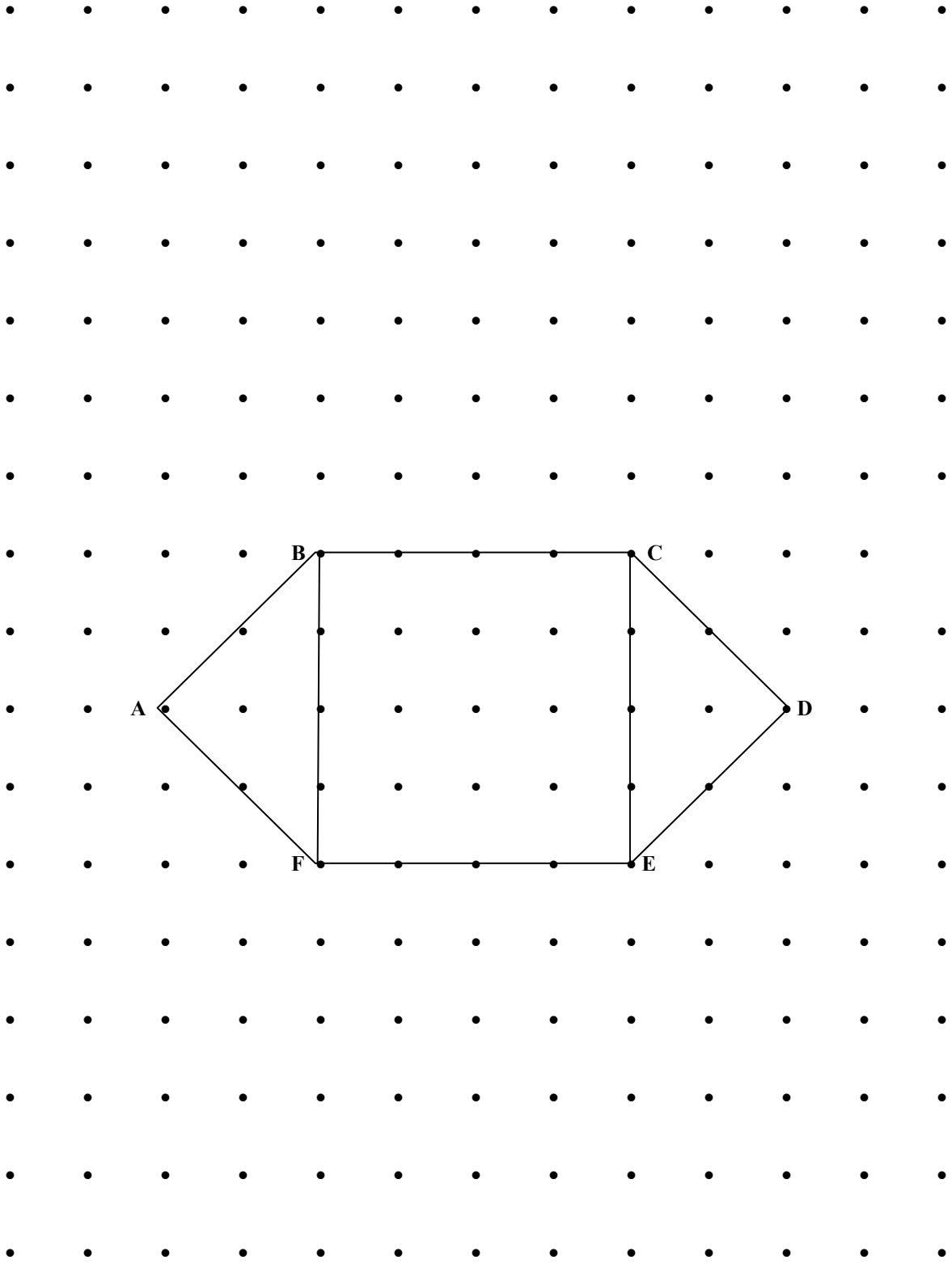
- Copies of the “Shapes in Motion Using Auto CADD” task sheets
- Auto CADD
- Mathematics Rubric

NAME _____ DATE _____

SHAPES IN MOTION USING AUTO CADD

Student Task Sheet

- A. Using the attached sheet of dot paper as a guide, recreate this layout. Turn on the grid and set the spacing at $\frac{1}{2}$ inch. Also turn on the snap, and set the spacing to the same value as the grid. Label the vertices A, B, C, D, E and F. Perform the following transformations:
- 1) Rotate the image of figure ABCDEF counter clockwise 90° centered at the point A. Clearly label your pre-image and image. Change the color of the rotated image using change properties.
 - 2) Take this image and reflect it about the line containing the original segment BF. Change the color of this new image.
 - 3) Finally, take the latest figure and translate it four units horizontally. Change the color of this final image to 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) Save this result using the proper file naming protocol. Then do a save as, again using proper file naming protocol, but include the number '2' to designate this as the result for the new set of transformations that will produce the same results. Erase all but the original hexagon shape, and perform the same number and types of transformations to achieve the same final result but with the set of transformations performed in a different manner/order.



MATHEMATICS RUBRIC

NAME _____ DATE _____

- Exceeds standard (must receive a 4 in each area)
- Meets standard (must receive all 3's or a combination of 3's and 4's)
- Approaches standard (must receive all 2's or any combination which may include a 3 or a 4)
- Begins standard (has no 3's or 4's but not all 1's)
- Absent (has all 1's and 0's)

	Mathematical Knowledge	Strategic Knowledge	Explanation
4	<ul style="list-style-type: none"> • Wrote the right answer. • Used math words correctly to show understanding of how math works. • Worked it out with no mistakes. • Used the right math words and labeled the answers. 	<ul style="list-style-type: none"> • Identified all the important parts of the problem, and knew how they went together. • Showed all the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote what was done and why it was done. • If a drawing was used, all of it was explained in writing.
3	<ul style="list-style-type: none"> • Knew how to do the problem, but made small mistakes. 	<ul style="list-style-type: none"> • Identified most of the important parts of the problem. • Showed most of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote mostly about what was done. • Wrote a little about why it was done. • If a drawing was used most of it was explained in writing.
2	<ul style="list-style-type: none"> • Understood a little, but made a lot of big mistakes. 	<ul style="list-style-type: none"> • Identified some of the important parts of the problem. • Showed some of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote some about what was done or why it was done but not both. • If a drawing was used, some of it was explained in writing.
1	<ul style="list-style-type: none"> • Tried to do the problem, but didn't understand it. 	<ul style="list-style-type: none"> • Identified almost no important parts of the problem. • Showed almost none of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote or drew something that didn't go with the answer. • Wrote an answer that was not clear.
0	<ul style="list-style-type: none"> • No answer attempted. 	<ul style="list-style-type: none"> • No strategy shown. 	<ul style="list-style-type: none"> • No written explanation.
Score			