

DESIGN JET WINGS OF EQUAL AREA WITH AUTO CADD

Performance Standard (7A/9A/9C).I

Determine multiple ways of dividing a generic triangle into four triangles of equal area accordingly:

- *Mathematical knowledge:* know the properties of the medians or other auxiliary lines of triangles and the information needed to calculate the area of a triangle.
- *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 measure and compare quantities using appropriate units, instruments and methods (7A); demonstrate and apply geometric concepts involving points, lines and planes (9A); and construct convincing arguments and proofs to solve problems (9C),*** provide students with sufficient learning opportunities to develop the following skills:

- Calculate by an appropriate method the length, width, height, perimeter, area, volume, surface area, angle measures or sums of angle measures of common geometric figures, or combinations of common geometric figures.
- Describe and apply properties of a polygon or a circle in a problem-solving situation.
- Identify and apply properties of medians, altitudes, angle bisectors, perpendicular bisectors and midlines of a triangle.
- Develop conjectures about geometric situations with and without technology.

Employees performing architectural and mechanical drafting job duties must be able to utilize various Computer Aided Drafting (CAD) commands and functions such as line, object snaps, copy and area. Students will have the opportunity to utilize CAD skills and apply geometry to solve an aerospace design problem. In doing so, this assessment aligns with CAD standards within the Architectural Drafting Cluster and Mechanical Drafting Cluster occupational skill standards. It also addresses Industrial 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 #19 (Students will develop an understanding of and be able to select and use manufacturing technologies.)

2. Provide each student a copy of the "Design Jet Wings of Equal Area with Auto CADD" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students to complete the following task in a classroom setting:
Divide the triangular piece of metal represented by figure ABC into four triangles, which represents four wing designs with equal areas, based on geometric principles. Sketch two other ways to divide triangle ABC into four triangular wing designs with equal areas and explain in words what you did and why you did each step. Justify your solution using geometric properties.
4. Evaluate each student's work using all three dimensions of the rubric and its guide to determine the performance level. For a score of 4 in mathematical knowledge, the student should complete 2 correct solutions of the more than 30 possible solutions. For a 3 in mathematical knowledge, the student must have 1 correct solution and a nearly correct second solution. For a 4 in strategy, the student must utilize medians or other auxiliary lines to divide triangles into equal area triangles. For a 4 in explanation, the student must be precise in the description of the use of medians and why they will guarantee equal areas.
5. Students should be able to find patterns in the length of the base and heights of triangles that make them equal in area. Students may consider looking at the formula for the area of a triangle.

Examples of Student Work

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

Time Requirements

- One class period

Resources

- Copies of the "Design Jet Wings of Equal Area with Auto CADD" task sheet
- Auto CADD
- Mathematics Rubric

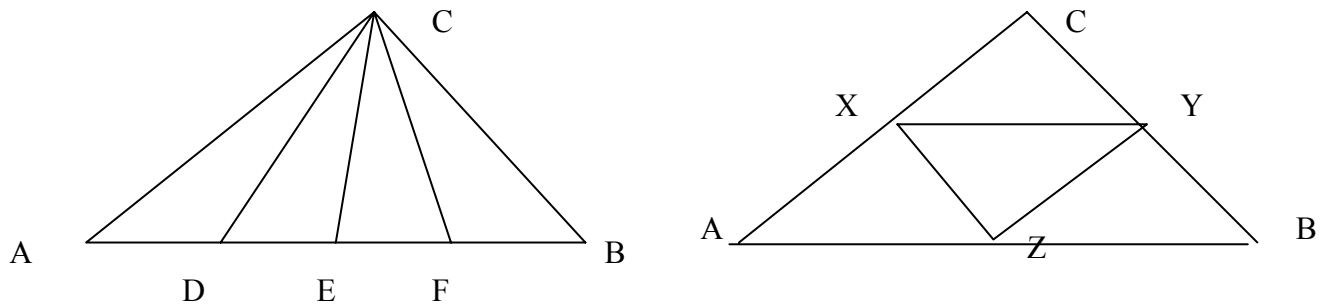
ASSESSMENT (7A/9A/9C).I

NAME _____ DATE _____

DESIGN JET WINGS OF EQUAL AREA WITH AUTO CADD

Student Task Sheet

Use the CADD program to draw a triangular shaped piece of metal ABC. Divide this triangular shape, ABC into 4 triangular wing designs with equal areas. Two examples are shown. The first (below left), has E as the midpoint of AB, D as the midpoint of AE and F as the midpoint of EB. The other example (below right) uses midpoints of AB, BC and CA.



Using Auto CADD, construct another triangle of any size. Label it LMN, and make a copy. Now, sketch at least four ways to divide triangle LMN into four different triangular wings with equal areas. Verify the area of each newly created triangular wing with the calculation function for area. Discuss the geometric properties of the new triangular wings. What features in each of these new triangular wings are identical? Describe in words what geometric properties you are using and why the areas end up the same.

Adapted from "A Triangle Divided," Mathematics Teacher, October 2000, pp. 608-611.

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			