Lesson Title	Let's Fold!
Length of Lesson	50 minutes
Created By	Emily Burtnett
Subject	Geometry
Grade Level	9^{th}, 10^{th}, 11^{th}, 12^{th}
State Standards	Geometry 3e
DOK Level	2
DOK Application	Investigate, apply, and prove properties and theorems from postulates and definitions related to angles, lines, circles, polygons, and two- and three-dimensional figures. Explore applications of patterns and transformational geometry. Classify triangles and apply postulates and theorems to test for triangle inequality, congruence, and similarity.
National Standards	Use visualization, spatial reasoning, and geometric modeling to solve problems.
Graduate Research Element	Unstructured grids in CFD offer maximum flexibility when computationally solving the flow around an object, such as an airfoil: in theory, you can put a grid around anything, no matter how complicated. Newer unstructured CFD codes allow users to use "n-sided" polygons, where the CFD grid can be made up of cells with an arbitrary number of faces.

Student Learning Goal:
The students will become familiar with shapes (rectangles, squares, triangles, "n-sided" polygons. They will learn to define a square, right-angle triangle, isosceles and equilateral triangles, as well as congruent triangles through a "hands on" proof by paper folding or origami.

Materials Needed (supplies, hand-outs, resources):
Instructions (handout), colored 4x4 paper squares (per person: 6-30 units)

Lesson Performance Task/Assessment:
Build squares following the instructions. Students assemble folded paper to form a cube, tetrahedron, octahedron or icosahedrons. Students will recognize the shapes without the ability to justify the identification. Students will analyze and discuss squares and equilateral triangles. Students will unfold the square and look at the creases: counting triangles, identifying congruent triangles, etc. Students formalize attributes of shapes while making informal deductions by comparing geometric shapes.

Lesson Relevance to Performance Task and Students:
The students are familiar with all the shapes and triangles involved in this project. They have seen them in textbooks and solved for the angles by using formulas and identifying using given information. This is a hand-on or visual "proof" of such concepts, and it will open their eyes to geometry all around them in the real world by learning to recognize geometric shapes.

Anticipatory Set/Capture Interest:
The students will be shown unstructured grids (n-sided polygons) used in CFD and how it is useful. This may overwhelm the students' so the instructor will show an unfolded consumer box to discuss the marvels of geometry in real world applications.

Guided Practice:
Instructor will show an example of the final product, and lead discussions.

- How do we define a square?
- Is the triangle equilateral? How do you know?
- How many equilateral triangles do you see?
- Congruent Triangles: Why do we say 'congruent' rather than 'equal'?
- How do we find the area and volume of the polygons?

Independent Practice:
Students fold the squares and assemble them into a cube, stellated tetrahedron, octahedron or icosahedrons.

Remediation and/or Enrichment:
Students will be asked to fold and assemble on their own, however, for remediation, the instructor may allow the students to work in small groups and assist as needed. Individual IEPs will be supported.

For enrichment, students can accept the challenge of building a 30 unit stellated icosahedrons. Students can also experiment with patterns using various colors of paper.

Check(s) for Understanding:
Participate in the discussions, follow the instructions, form the appropriate shape and can identify the shapes.

Closure:
Squares, triangles, and their properties. Easy, cool trick with square pieces of paper. Geometry is everywhere, has aesthetic value, and many applications!

Possible Alternate Subject Integrations:
History (origins of paper-folding)

Teacher Notes:
Allow students plenty of time to fold and construct – this gives students the opportunity to try a more difficult polygon if they finish the cube early.