



Advanced Concepts of Geometry

Lesson Plan
Grades 6–8

ISTE NETS S Standards

- III. Technology productivity tools
- IV. Technology Communications tools
- V. Technology research tool

Geometry, Concepts and Algorithms Focus

Students will explore two- and three-dimensional geometry and geometric figures. After viewing a video on *unitedstreaming*, they will demonstrate real-life geometric applications using Google SketchUp. Allow three class periods.

Content Standards

- Precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties.
- Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.
- Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.
- Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling.
- Examine the congruence, similarity, and line or rotational symmetry of objects using transformations.
- Use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume.

Learning Objectives

- Demonstrate correct mathematical symbolic notation in identifying and describing geometric shapes.
- Describe how three-dimensional shapes can be positioned at specific angles to each other.
- Represent intersecting lines and relationships of angles within a two-dimensional and three-dimensional figure.

Technology Components

- Discovery Education *unitedstreaming* account (<http://www.unitedstreaming.com>).
- Google SketchUp software (free download at <http://sketchup.google.com>)
- Computer with LCD projector and Internet connection.
- Access to the Internet for teacher- and student-based research.

Preparation

- Preview video *The Many-Sided World of Geometry, Program 1: Geometry Basics* on *unitedstreaming*.



- Become familiar with Google SketchUp to develop three-dimensional figures from two-dimensional shapes and to measure angles at intersecting points on figures.
- Review and download any of the models from the Google 3-D Warehouse (free and available through the program).

Lesson Starter

- Review the geometrical concepts in *The Many-Sided World of Geometry, Program 1: Geometry Basics on unitedstreaming*.
- Using Google SketchUp, demonstrate how to create lines and shapes and how to measure them at discrete angles.

Prior Knowledge

- Identify two-dimensional and three-dimensional shapes and their respective properties.
- Measure simple angles using lines and points.

Present New Content

- Brainstorm the geometrical considerations that might exist for someone constructing a house.
- Demonstrate for students how to model a three-dimensional figure using Google SketchUp.
- Demonstrate how to measure angles at intersecting points in the figure.
- Use Google SketchUp to present the MyBuilding.skp file of a three-dimensional representation of their project.
- Use *The Many-Sided World of Geometry, Program 1: Geometry Basics* as a resource for students to further explore and comprehend geometric concepts.

Independent Learning Experience

- Divide students into collaborative groups. Ask them to use SketchUp to complete an initial design of a house, identifying required geometric algorithms and concepts.
- Ask groups to share their houses with other groups, highlighting geometrical aspects.

Cross-Curricular Lesson Extension

- Add a science component by adding windows to the structure. What role do windows play in temperature gain or loss? How do windows reduce the need for electric lighting? Should all sides of a building have the same amount of area devoted to windows?
- Using the area tool, create a bill of materials for the house's design (X amount of wood, X amount of paint, X amount of wallpaper) and calculate the cost.

Feedback

- Circulate around the room, providing ongoing feedback to small groups.
- Ask student groups to submit a final draft of their building, demonstrating required algorithms and concepts. Have them identify the three-dimensional geometric shapes used and their properties.



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Assessment

- Provide a rubric in advance showing the geometric concepts required to design a house. Use the presentations as a performance assessment to encourage students to use appropriate mathematical language to explain the design of their group's house.

Transfer

- Provide images of different forms of housing. Student groups can choose one form to research and present a geometrical design of that form. Students can highlight important geometric features of the house and contrast them against the designs of other houses.

Citation

Many-Sided World of Geometry, The, Program 1: Geometry Basics (2002), *unitedstreaming*, <http://www.unitedstreaming.com/>