Gears
Educational Systems, LLC

Perimeter, Area and Volume

Visualizing and Describing The Geometry of Totally Trebuchet

Description

Engineering teams can solve challenging problems because they possess complex sets of shared skills and competencies. Visualization is one of these shared skill sets. It is the ability to imagine, understand and describe the relationships that exist between ideas or solid objects.

Note: Mechanical engineers refer to solid objects used in machines and mechanisms as parts or components.

Visualization skills include the ability to:

- "See" relationships and interactions in the "Minds Eye".
- Demonstrate these interactions and relationships using sketches, drawings, computer generated solid models/animations or examples of working models and assemblies.
- Mathematically describe the relationship and interaction of ideas or components.

Geometry is a branch of mathematics that enhances our ability to understand and describe components. In this lesson we will explore ways to use the geometric concepts of perimeter, area and volume to help us better imagine and understand the Totally Trebuchet components.

Terms Concepts and Definitions

Visualization	Perimeter	Surface Area
Rectilinear	Area	Polyhedron
Regular Polygon	Volume	Quadrant
Extrude	Cartesian Coordinate System	Pythagorean Theorem
Mass Properties	Sphere	Cylinder
Rectangle	Cone	Pyramid
Parallelogram	Prisms	Solids

Materials/Equipment/Supplies/Software (Suggestions Only)

Notebook paper	Calculator	SolidWorks™ Software
Pencil/Pen	Spread Sheet	GEARS-Trebuchet Kit
Straight edge		

Mathematics Standards Addressed in This Lesson

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Use visualization, spatial reasoning, and geometric modeling to solve problems

Objectives

Students and teachers who participate in this lesson will:

1. Calculate the perimeter and areas of regular polygons
2. Calculate the volume of regular polyhedrons, cylinders, cones and spheres
3. Identify, describe and calculate the perimeter of Totally Trebuchet components.
4. Identify, describe and calculate the surface area of Totally Trebuchet components
5. Identify, describe and calculate the volume of Totally Trebuchet components
6. Use SolidWorks™ to confirm the accuracy of the area or volume calculation performed in this lesson.

Lesson Content

Perimeter, area and volume are often used as measures of the amount of material contained within a specific component or assembly. Surface area and volumetric quantities are used for a variety of calculations including; Weight, density, cost and strength of materials.

The lesson begins with a description of how to calculate the perimeter and area of basic geometric shapes. Following this is a discussion and examples of how to calculate volume of basic shapes. The purpose is to develop the competencies needed to calculate the perimeter, area and volume of compound shapes. Combining basic shapes such as squares, rectangles, triangles, and circles forms compound shapes. The area and volume of compound shapes is calculated by summing the areas and volumes of the basic shapes.

The lesson will conclude with examples of how to calculate the perimeter, area and volume of compound shapes that form the parts and components in the GEARS-IDS™ Trebuchet kit. The lesson includes examples of how to quickly and accurately calculate the perimeter, area and volumes of regular or compound shapes using SolidWorks™ design software.