Lesson 2.1 – Geometric Shapes and Solids

Concepts

1. Geometric shapes describe the two or three dimensional contours that characterize an object.
2. The properties of volume and surface area are common to all designed objects and provide useful information to the engineer.
3. CAD systems are used to increase productivity and reduce design costs.
4. Geometric and numeric constraints are used to define the shape and size of objects in CAD modeling systems.
5. Solid CAD models are the result of both additive and subtractive processes.

Performance Objectives

It is expected that students will:

- Identify common geometric shapes and forms by name.
- Calculate the area of simple geometric shapes.
- Calculate the surface area and volume of simple geometric forms.
- Identify and explain the various geometric relationships that exist between the elements of two-dimensional shapes and three-dimensional forms.
- Identify and define the axes, planes, and sign conventions associated with the Cartesian coordinate system.
- Apply geometric and numeric constraints to CAD sketches.
- Utilize sketch-based, work reference, and placed features to develop solid CAD models from dimensioned drawings.
- Explain how a given object's geometry is the result of sequential additive and subtractive processes.

Essential Questions

1. What are some examples of simple geometric shapes?
2. What two-dimensional shapes are most often associated with three-dimensional forms?
3. For what reasons might a designer need to know the volume and surface area of an object?
4. What is the difference between a geometric constraint and a numeric constraint?
5. What kind of additive and subtractive processes are used to manufacture actual physical objects?

Key Terms

Acute Triangle	**Angle**	**Area**
Axis	**Computer-Aided Design or Computer-Aided Drafting (CAD)**	**Cartesian Coordinate System**
Chamfer	**Circle**	**Circumscribe**
Counterbore	**Countersink**	**Cylinder**
Diameter	**Ellipse**	**Extrusion**
Geometric Constraint	**Inscribe**	**Mass**
Numeric Constraint	**Obtuse Triangle**	**Origin**
Parallelogram	**Pattern**	**Pi**
Plane	**Polygon**	**Prism**
Quadrilateral	**Radius**	**Rectangle**
Regular Polygon	**Revolution**	**Right Triangle**
Rotation	**Round**	**Solid**
Solid Modeling	**Space**	**Square**
Surface Area	**Tap**	**Taper**
Three-Dimensional	**Triangle**	**Two-Dimensional**
Vertex	**Volume**	**Working Drawings**

Instructional Resources

PowerPoint Presentations

- Geometric Shapes and Area
- Properties of Geometric Solids
- Additive and Subtractive Solid Modeling

Word Documents

- Project 2.1.1 Shape and Measurement Madness

Activity 2.1.2 Calculating Properties of Shapes

Activity 2.1.3 Making Sketches in CAD

Activity 2.1.4 Calculating Properties of Solids

Activity 2.1.5 CAD Model Features

Project 2.1.6 Modeling Creation

Lesson 2.1 Key Terms and definitions in Excel

Reference Sources

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