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Module 10 **Coordinate Geometry and Spatial Visualization**
Lesson 4 **Three-Dimensional Shapes**

Lesson Notes 10.4

Lesson Objectives

- Identify three-dimensional geometric figures using models (rectangular prisms, cylinders, cones, pyramids, and spheres).
- Use properties of standard three-dimensional shapes to identify, to classify, and to describe them.

Subtopic 1 Polyhedra: Prisms and Pyramids

A **solid** is a three-dimensional geometric figure.

A solid is called a polyhedron in which all the surfaces, called faces, are **polygons**.

Polyhedra-- *pl* of polyhedron.

The intersections of the faces are the **edges**.

The points where three or more edges **intersect** are the vertices.

Polyhedra are classified by the number of **faces**.

Platonic solids

- **Convex** regular polyhedrons
- Exactly **five** different ones

A polyhedron with four faces is a **tetrahedron**.

A polyhedron with **six** faces is a hexahedron.

A polyhedron with eight faces is an **octahedron**.

A polyhedron with **12** faces is a dodecahedron.

A polyhedron with 20 faces is an **icosahedron**.

Polyhedra are convex or **nonconvex**.

A polyhedron is **convex** if a line segment that lies entirely inside or on the polyhedron can connect all sets of two points on its surface.

A polyhedron is regular if all its **faces** are congruent regular polygons.

A **prism** has two congruent parallel faces.

The congruent **parallel** faces are called bases.

The **lateral** faces are rectangles or parallelograms.

The altitude of a prism is a **perpendicular** segment that joins the planes of the bases.

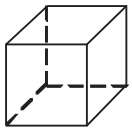
A pyramid has **one** base that can be any polygon.

The lateral faces are **triangles** that meet at a common vertex.

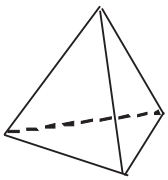
The altitude is the perpendicular segment from the base to the **vertex**.

Prisms and pyramids are named by the shapes of their **bases**.

1 How many faces, edges, and vertices does each solid have?

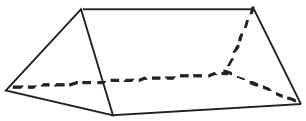


Six faces
Twelve edges
Eight vertices

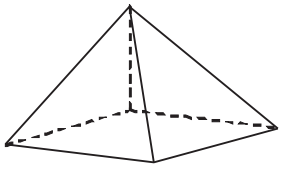


Four faces
Six edges
Four vertices

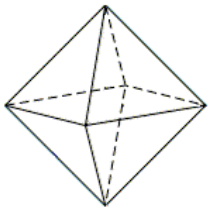
2 Classify each polyhedron.



Triangular prism



Rectangular pyramid



Octahedron

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Module 10 Coordinate Geometry and Spatial Visualization
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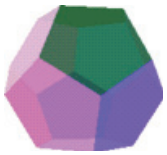
3 Sketch a rectangular prism.

4 Identify which of these figures is the polyhedron.

Polyhedron

5 Classify each polyhedron as convex or nonconvex.



Nonconvex **Convex**

Subtopic 2 **Spheres, Cylinders, and Cones**

A **sphere** is the set of all points in space that are a given distance from a fixed point called the **center** of the sphere.

A sphere does not have **edges** or vertices.

A line segment from the center of the sphere to a point on the sphere is a **radius**.

A cylinder has two parallel congruent **circular** bases.

The bases are connected by a curved **lateral** surface.

The **altitude** is a line segment that joins the planes of the bases and is perpendicular to the bases.

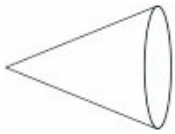
The radius of a **base** is also called the radius of the cylinder.

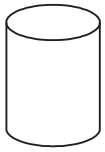
A **cone** has one circular base and a single vertex.

The altitude is the perpendicular segment from the plane of the base to the **vertex**.

The radius of the base is also called the **radius** of the cone.

6 Identify each solid.



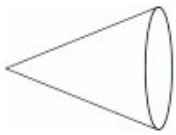


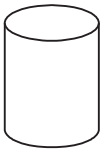
Cone **Cylinder**

7 How is a sphere different from a cylinder?

A sphere does not have any bases. A cylinder has two circular bases.

8 Explain how to find the altitude and radius of each solid.





To find the altitude of the cone, I measure the perpendicular line segment from the base to the vertex. To find the radius of the cone, I measure the distance from the center of the circular base to the outer boundary of the base.

To find the altitude of the cylinder, I measure the perpendicular distance from the plane of one base to the other. To find the radius of the cylinder, I measure the distance from the center of a circular base to the outer boundary of the base.