**EXPLORING SOLIDS & CROSS–SECTIONS NOTES** **NAME:** KEY

**GEOMETRY** **DATE:** _____ **PERIOD:** ___

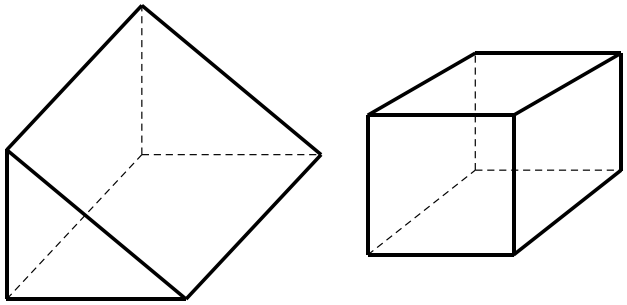
**Learning Targets:**

- ✓ Explore and name various solids
- ✓ Identify edges, faces, and vertices of a figure
- ✓ Use Euler's Formula to determine the number of vertices, faces, or edges
- ✓ Describe the cross–section of a plane and a solid
- ✓ Rotate a two-dimensional figure about an axis to create a three-dimensional figure

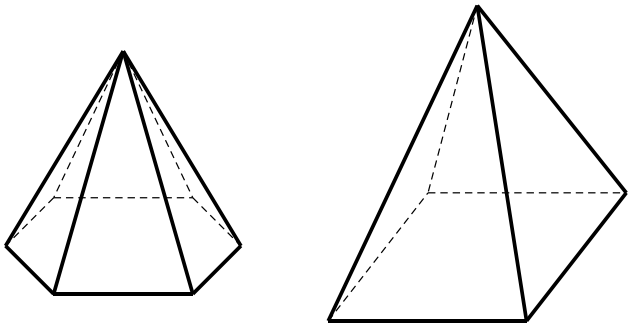
- A **polyhedron** is a solid that is bounded by polygons, called **faces**, that enclose a single region of space.
- An **edge** of a polyhedron is a line segment formed by the intersection of two faces.
- A **vertex** of a polyhedron is a point where three or more edges meet.
- The plural of polyhedron is *polyhedra*, or polyhedrons.

**FAMILIES OF SOLIDS**

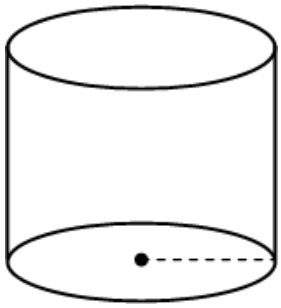
**Name:** Prism
**POLYHEDRA**



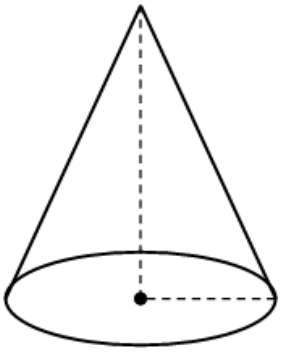
**Name:** Pyramid
**POLYHEDRA**



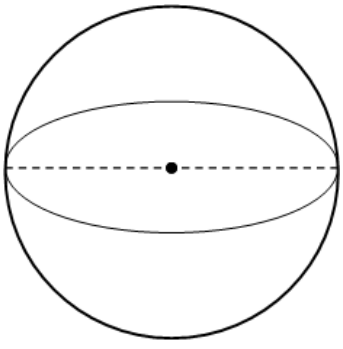
**Name:** Cylinder
**NOT A POLYHEDRON**



**Name:** Cone
**NOT A POLYHEDRON**



**Name:** Sphere
**NOT A POLYHEDRON**

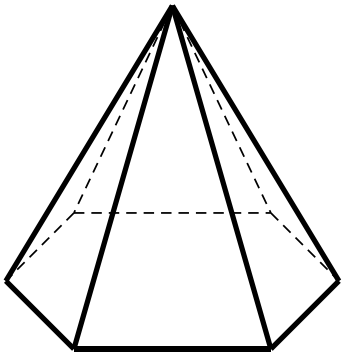


**1)** Why are the "circular solids" above NOT considered polyhedra?

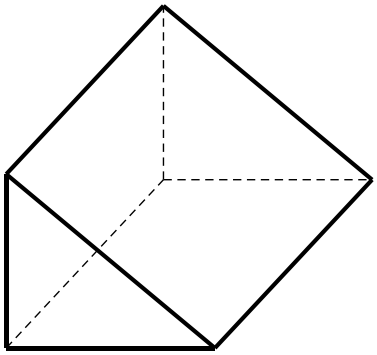
They have "sides" or "faces" that are not polygons

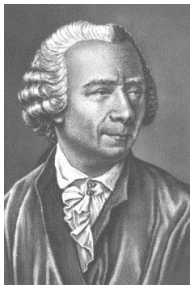
*For #s 2–3, name the figure, count the number of faces, edges, and vertices of each polyhedron.*

**2)** Name: **Hexagonal Pyramid**
Faces: **7** Edges: **12** Vertices: **7**



**3)** Name: **Triangular Prism**
Faces: **5** Edges: **9** Vertices: **6**





**Euler's Theorem**
(also known as **Euler's Formula**)

**F + V – E = 2**

where,
***V***= # of **vertices** of the polyhedron
***F***= # of **faces** of the polyhedron
***E***= # of **edges** of the polyhedron


*For #s 4–5, use Euler's Theorem to answer the questions.*

**4)** If a solid has 8 **faces** and 12 **vertices**, how many **edges** will it have?

**F + V – E = 2**
**8 + 12 – E = 2**
**20 – 2 = E**
**18 = E**

**5)** If a solid has 8 **faces** and 12 **edges**, how many **vertices** will it have?

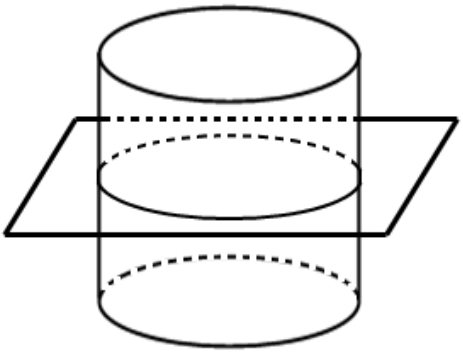
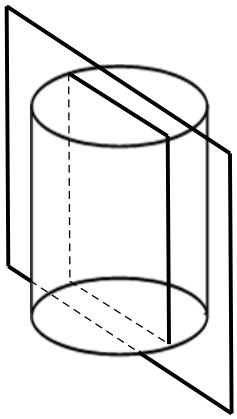
**F + V – E = 2**
**8 + V – 12 = 2**
**V – 4 = 2**
**V = 6**

**You Try!**
**#6**

*If a solid has 14 faces and 36 edges, how many vertices will it have?*

**F + V – E = 2**
**14 + V – 36 = 2**
**V – 22 = 2**
**V = 24**

✸ A **cross–section** is the _____intersection_____ of a _____solid_____ figure and a _____plane_____.

| **Cross–Section A: Parallel to the Base** | **Cross–Section B: Perpendicular to the Base** |
|---|---|
|  |  |
| Cross–Section A is in the shape of a _____circle_____.<br><br>*Any cross section made parallel to the base of a prism/cylinder will have the same shape as the base of the figure.* | Cross–Section B is in the shape of a _____rectangle_____.<br><br>*Since the bases of the cylinder meet the lateral face (the curved surface) at a right angle, the vertical cross–section must also contain four right angles.* |

**Discuss:**

✓ Why does the cross–section in A *appear* to be an oval or ellipse? **perspective**

✓ Is it possible for a cross–section of a cylinder to have a shape other than those identified above? **Yes, if sliced at an angle (for example)**

*For #s 7–10, describe the <u>vertical</u> cross section of each item (perpendicular to the "base").*

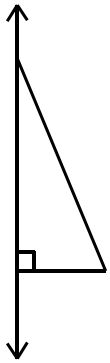
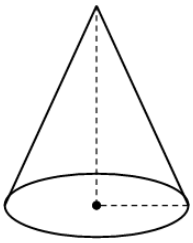
| | |
|---|---|
| **7)** _____circle_____<br>  <br>(Orange) | **8)** _____rectangle_____<br>  <br>(Tree Trunk) |
| **9)** _____triangle_____<br>  <br>(Ice Cream Cone) | **10)** _____ellipse_____<br>  <br>(Mango) |

**Activity: Generating Three–Dimensional Figures**

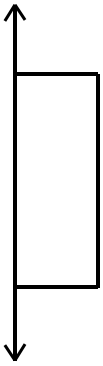
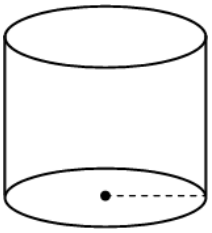
1. Cut out the following shapes from a piece of card stock: right triangle, rectangle, semi–circle
2. One at a time, tape the flat edge of each shape to the wooden dowel (or the end of your pencil)
3. Twirl the wooden dowel between your hands to see the 3–dimensional figure generated by the rotation.
4. Sketch the 3–D figure in the box provided and name the figure you generated.

**EXTEND:** Make up your own shape and cut it out. Perform the same activity to see what the 3–D rotation of your figure looks like. Sketch the 2–D and resulting 3–D figures in the box provided.

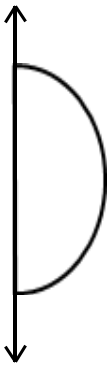
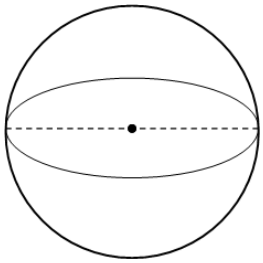
**11) Right Triangle**

| 2–D Figure and Line of Rotation | 3–D Figure Generated by the Rotation |
|---|---|
|  | **Cone**  |

**12) Rectangle**

| 2–D Figure and Line of Rotation | 3–D Figure Generated by the Rotation |
|---|---|
|  | **Cylinder**  |

**13) Semi–Circle**

| 2–D Figure and Line of Rotation | 3–D Figure Generated by the Rotation |
|---|---|
|  | **Sphere**  |

**14) Create–Your–Own Figure**

| 2–D Figure and Line of Rotation | 3–D Figure Generated by the Rotation |
|---|---|
|  | **Answers will vary** |