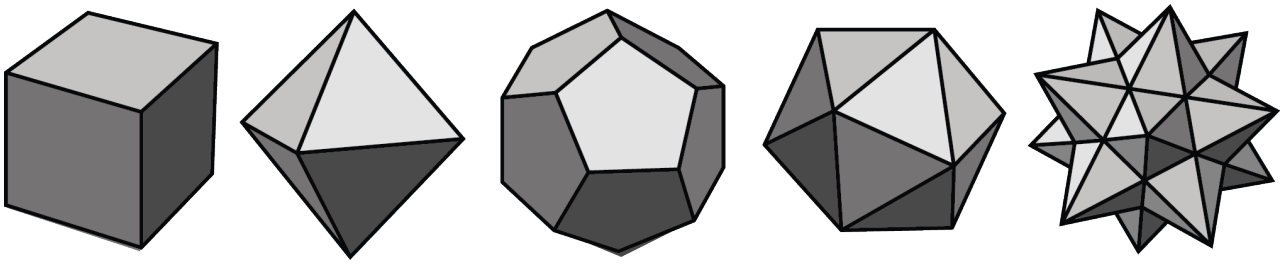
Polyhedra and Nets

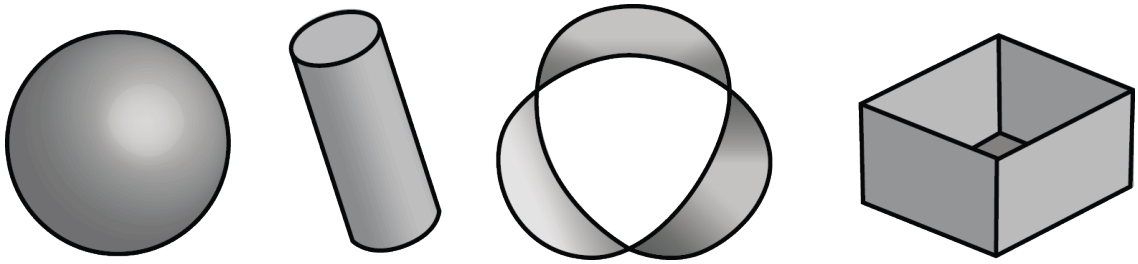
Let's use nets to find the surface area of polyhedra.

11.1 What Are Polyhedra?



These five drawings represent **polyhedra**.

The next four drawings do *not* represent polyhedra.

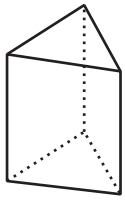


1. Your teacher will give you some figures or objects. Sort them into polyhedra and non-polyhedra.
2. What characteristics helped you distinguish the polyhedra from the other figures?

11.2 Prisms and Pyramids

1. Here are some polyhedra called **prisms**.

A



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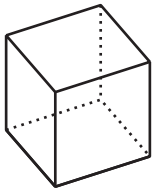

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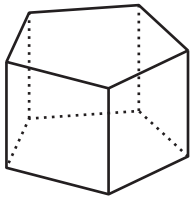

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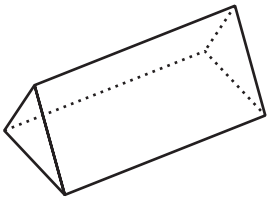

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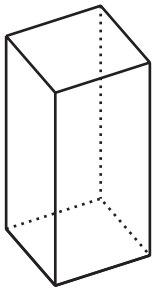
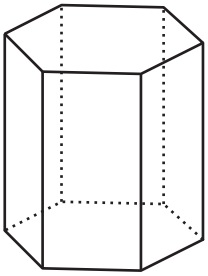
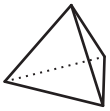


F



Here are some polyhedra called **pyramids**.

P



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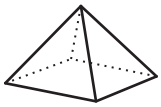

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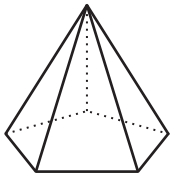
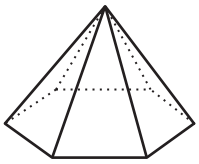


S



a. Look at the prisms. What are their characteristics?

b. Look at the pyramids. What are their characteristics?

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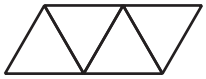
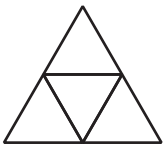
2. Which of these **nets** can be folded into Pyramid P? Select all that apply.



Net 1



Net 2

Net 3

3. Your teacher will give your group some polygons and assign a polyhedron.

   a. Decide which polygons are needed to compose your assigned polyhedron. List the polygons and how many of each are needed.

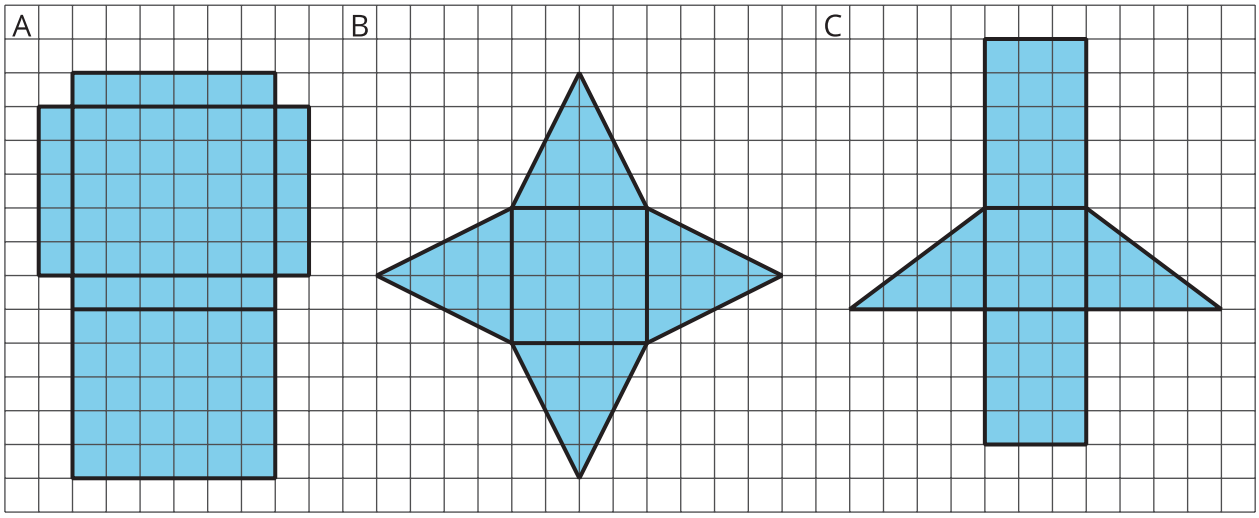
   b. Arrange the cut-outs into a net that, if taped and folded, can be assembled into the polyhedron. Sketch the net. If possible, show a different net for the same polyhedron.

Are you ready for more?

What is the smallest number of faces a polyhedron can possibly have? Explain how you know.

11.3 Using Nets to Find Surface Area

1. Name the polyhedron that each net would form when assembled.



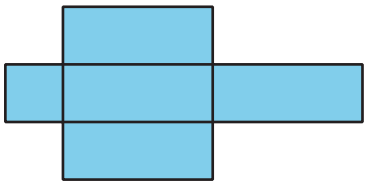
2. Your teacher will give you the nets of three polyhedra. Cut out the nets and assemble the three-dimensional shapes.

3. Find the surface area of each polyhedron. Explain or show your reasoning.

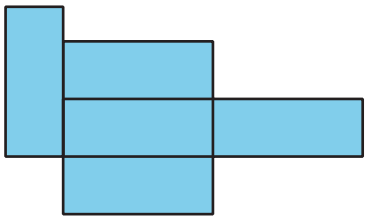
Are you ready for more?

1. For each net, decide if it can be assembled into a rectangular prism.

A



B



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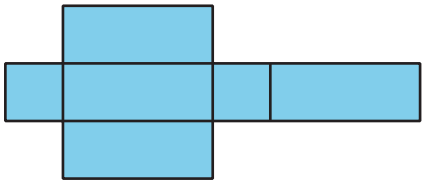
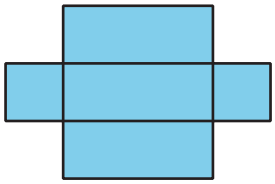
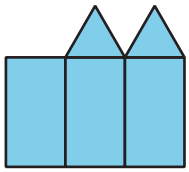


D

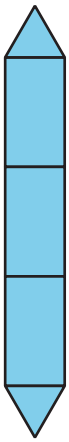


2. For each net, decide if it can be folded into a triangular prism.

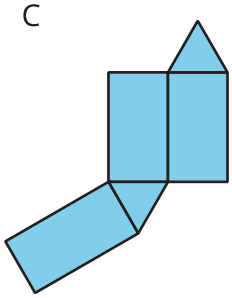
A



B



C



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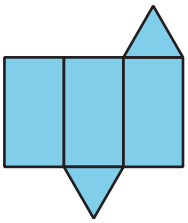
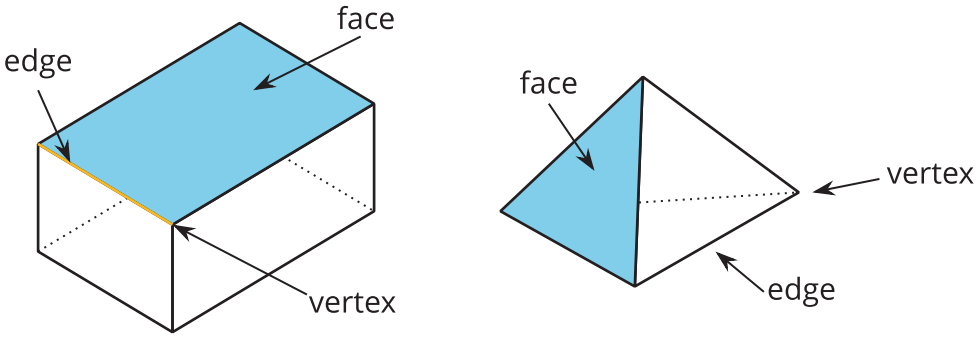


Lesson 11 Summary

A **polyhedron** is a three-dimensional figure composed of faces. Each face is a polygon and meets only one other face along a complete edge. The ends of the edges meet at points that are called *vertices*.

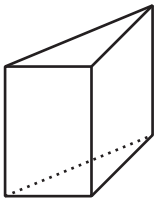


A polyhedron always encloses a three-dimensional region. The plural of "polyhedron" is "polyhedra."

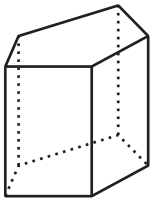
A **prism** is a type of polyhedron with two identical faces that are parallel to each other and that are called **bases**. The bases are connected by a set of rectangles (or sometimes parallelograms that aren't rectangles).

A prism is named for the shape of its bases. For example, if the base is a pentagon, then it is called a "pentagonal prism."

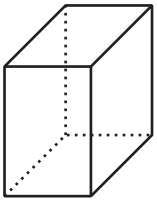
triangular prism



pentagonal prism



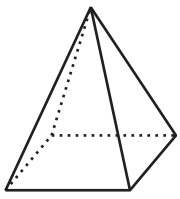
rectangular prism



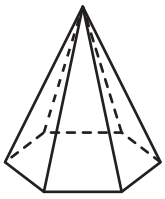
A **pyramid** is a type of polyhedron that has one special face called the *base*. All of the other faces are triangles that all meet at a single vertex.

A pyramid is named for the shape of its base. For example, if the base is a pentagon, then it is called a "pentagonal pyramid."

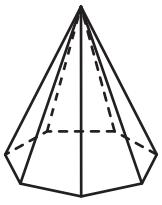
rectangular pyramid



hexagonal pyramid



heptagonal pyramid



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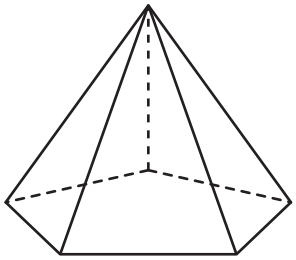
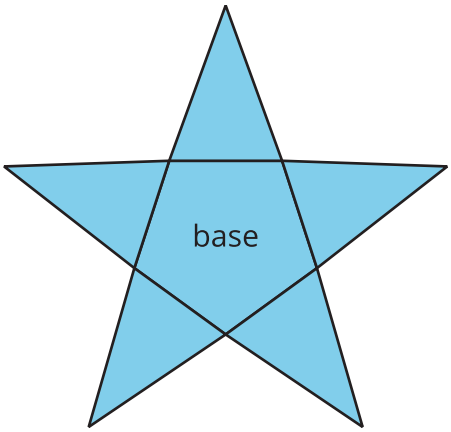
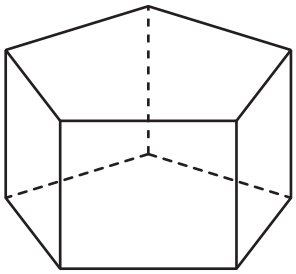
A **net** is a two-dimensional representation of a polyhedron. It is composed of polygons that form the faces of a polyhedron.

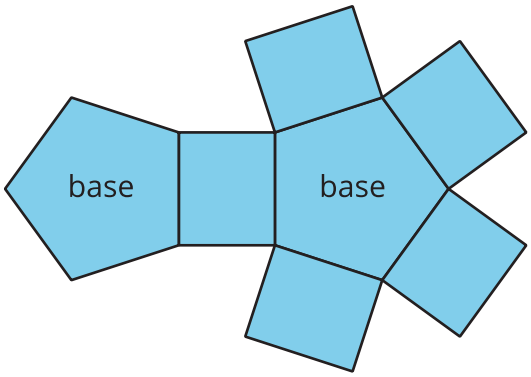
A net of a pyramid has one polygon that is the base. The rest of the polygons are triangles. A pentagonal pyramid and its net are shown here.





A net of a prism has two copies of the polygon that is the base. The rest of the polygons are rectangles. A pentagonal prism and its net are shown here.





Because a net shows all the faces of a polyhedron, we can use it to find its surface area.