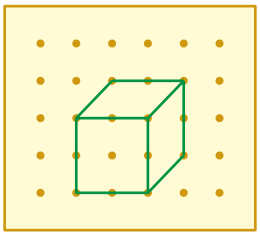
8.1 Three-Dimensional Figures

Essential Question How can you draw three-dimensional figures?

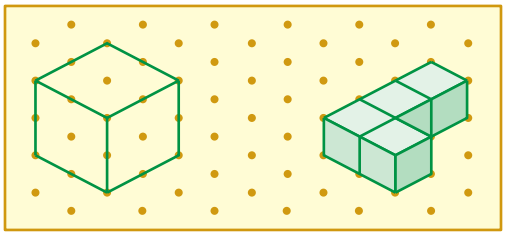
Dot paper can help you draw three-dimensional figures, or *solids*.

Square Dot Paper



Face-On view

Isometric Dot Paper

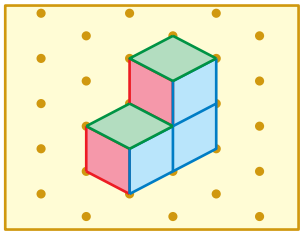


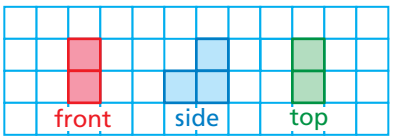
Corner view

1 ACTIVITY: Drawing Views of a Solid

Work with a partner. Draw the front, side, and top views of each stack of cubes. Then find the number of cubes in the stack.

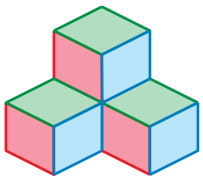
a. Sample:



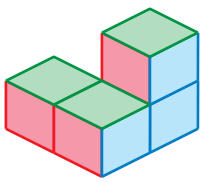


Number of cubes: 3

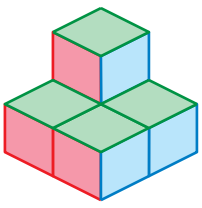
b.



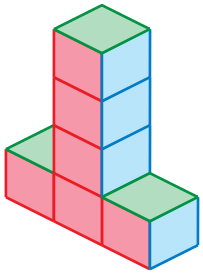
c.



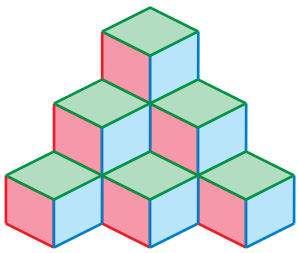
d.



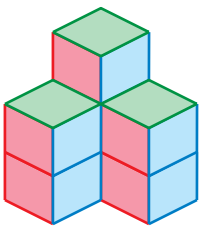
e.



f.



g.



Common Core

Geometry

In this lesson, you will

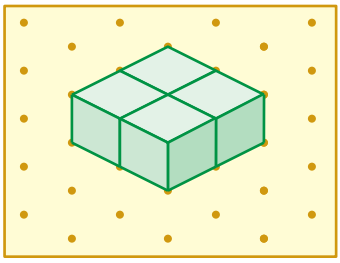
- draw three-dimensional figures.
- find the number of faces, edges, and vertices of solids.

Preparing for Standard 6.G.4

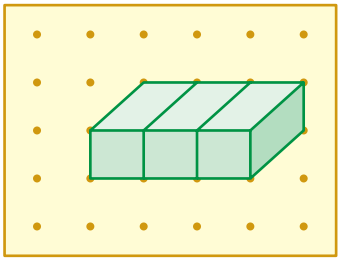
2 ACTIVITY: Drawing Solids

Work with a partner.

a. Use isometric dot paper to draw three different solids that use the same number of cubes as the solid at the right.

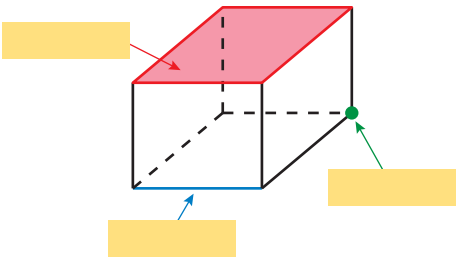


b. Use square dot paper to draw a different solid that uses the same number of *prisms* as the solid at the right.



3 ACTIVITY: Exploring Faces, Edges, and Vertices

Work with a partner. Use the solid shown.



a. Match each word to the figure. Then write a definition for each word.

face *edge* *vertex*

b. Identify the number of faces, edges, and vertices in a rectangular prism.

c. When using dot paper to draw a solid, what represents the vertices? How do you draw edges? How do you draw faces?

d. What do you think it means for lines or planes to be parallel or perpendicular in three dimensions? Use drawings to identify one pair of each of the following:

- parallel faces
- parallel edges
- edge parallel to a face
- perpendicular faces
- perpendicular edges
- edge perpendicular to a face

Math Practice 7

View as Components

What are the different parts of a three-dimensional object? How can dot paper help you draw the parts of the object?

What Is Your Answer?

4. IN YOUR OWN WORDS How can you draw three-dimensional figures?

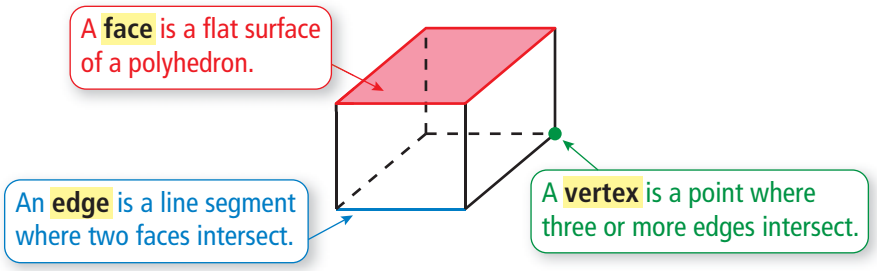
Practice Use what you learned about three-dimensional figures to complete Exercises 7–9 on page 358.

8.1 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

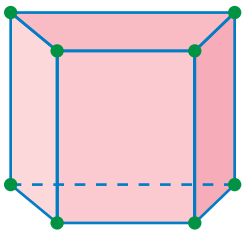
Key Vocabulary
solid, *p. 356*
polyhedron, *p. 356*
face, *p. 356*
edge, *p. 356*
vertex, *p. 356*
prism, *p. 356*
pyramid, *p. 356*

A **solid** is a three-dimensional figure that encloses a space. A **polyhedron** is a solid whose *faces* are all polygons.



EXAMPLE 1 Finding the Number of Faces, Edges, and Vertices

Find the number of faces, edges, and vertices of the solid.



The solid has 1 face on the bottom, 1 face on the top, and 4 faces on the sides.

The faces intersect at 12 different line segments.

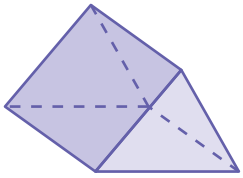
The edges intersect at 8 different points.

∴ So, the solid has 6 faces, 12 edges, and 8 vertices.

On Your Own

Now You're Ready
Exercises 10–12

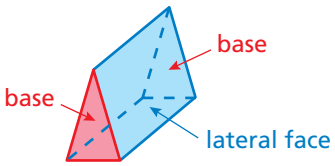
1. Find the number of faces, edges, and vertices of the solid.



Key Ideas

Prisms

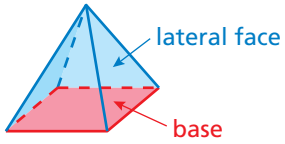
A **prism** is a polyhedron that has two parallel, identical *bases*. The *lateral faces* are parallelograms.



Triangular Prism

Pyramids

A **pyramid** is a polyhedron that has one base. The lateral faces are triangles.



Rectangular Pyramid

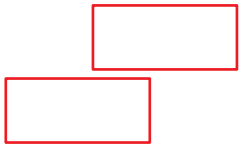
The shape of the base tells the name of the prism or the pyramid.

EXAMPLE 2 Drawing Solids

a. Draw a rectangular prism.

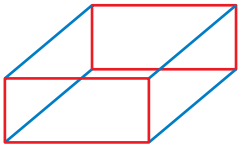
Step 1:

Draw identical rectangular bases.



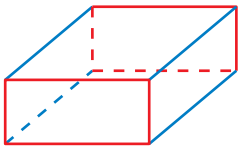
Step 2:

Connect corresponding vertices.



Step 3:

Change any *hidden* lines to dashed lines.



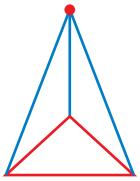
b. Draw a triangular pyramid.

Step 1:

Draw a triangular base and a point.

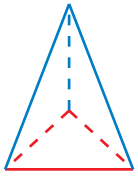
Step 2:

Connect the vertices of the triangle to the point.

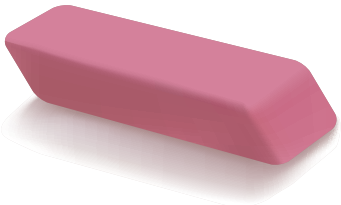


Step 3:

Change any *hidden* lines to dashed lines.



EXAMPLE 3 Drawing Views of a Solid



Draw the front, side, and top views of the eraser.

The front view is a parallelogram.

The side view is a rectangle.

The top view is a rectangle.

On Your Own

Now You're Ready
Exercises 13–22

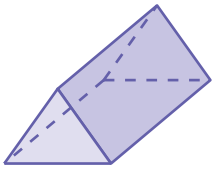
Draw the solid.

2. square prism

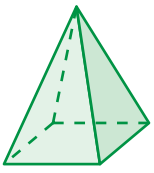
3. pentagonal pyramid

Draw the front, side, and top views of the solid.

4.



5.



8.1 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

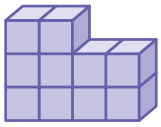
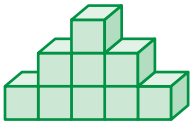
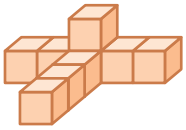
Vocabulary and Concept Check

LOGIC **Decide whether the statement is *true* or *false*. If false, explain your reasoning.**

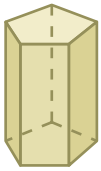
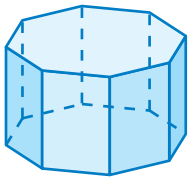
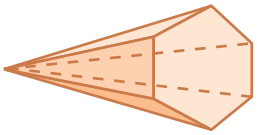
1. A triangular prism has three triangular faces.
2. A triangular prism has three rectangular faces.
3. A rectangular pyramid has one rectangular face.
4. A rectangular pyramid has three triangular faces.
5. All of the edges of a rectangular prism are parallel.
6. None of the edges of a rectangular pyramid are parallel.

Practice and Problem Solving

Draw the front, side, and top views of the stack of cubes. Then find the number of cubes in the stack.

7. 
8. 
9. 

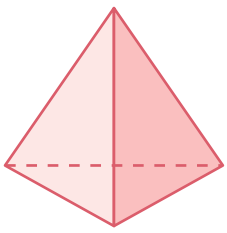
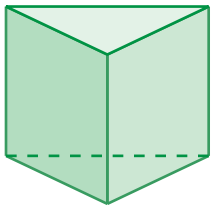
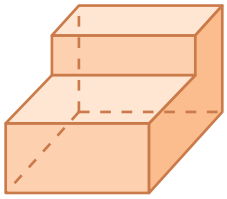
Find the number of faces, edges, and vertices of the solid.

1 10. 
11. 
12. 

Draw the solid.

2 13. triangular prism
14. pentagonal prism
15. rectangular pyramid
16. hexagonal pyramid

Draw the front, side, and top views of the solid.

3 17. 
18. 
19. 
20. 
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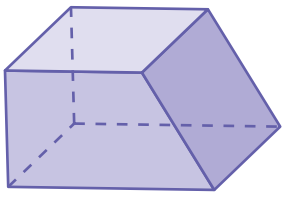
22. 

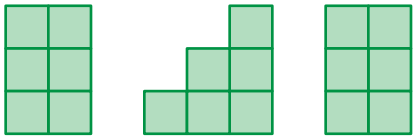
23. **PYRAMID ARENA** The Pyramid of Caius Cestius in Rome, Italy, is in the shape of a square pyramid. Draw a sketch of the pyramid.

24. **RESEARCH** Use the Internet to find a picture of the Washington Monument. Describe its shape.

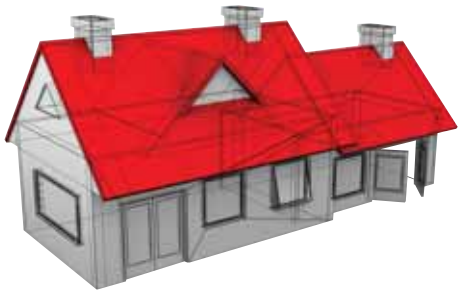
Draw a solid with the following front, side, and top views.

25.

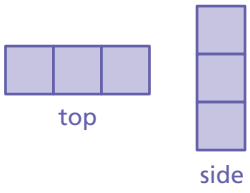
26.



27. **PROJECT** Design and draw a house. Name the different solids that you can use to make a model of the house.



28. **REASONING** Two of the three views of a solid are shown.



a. What is the greatest number of unit cubes in the solid?

b. What is the least number of unit cubes in the solid?

c. Draw the front views of both solids in parts (a) and (b).

29. Reasoning Draw two different solids with five faces.

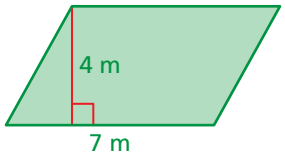
a. Write the number of vertices and edges for each solid.

b. Explain how knowing the numbers of edges and vertices helps you draw a three-dimensional figure.

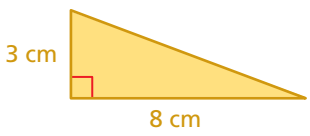
Fair Game Review What you learned in previous grades & lessons

Find the area of the figure. *(Section 4.1, Section 4.2, and Section 4.3)*

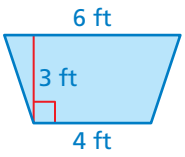
30.



31.



32.



33. **MULTIPLE CHOICE** Which statement is true when $x = -2$ and $y = |-2|$? *(Section 6.4)*

Ⓐ $x = y$ Ⓑ $y < 0$ Ⓒ $x > y$ Ⓓ $y > x$