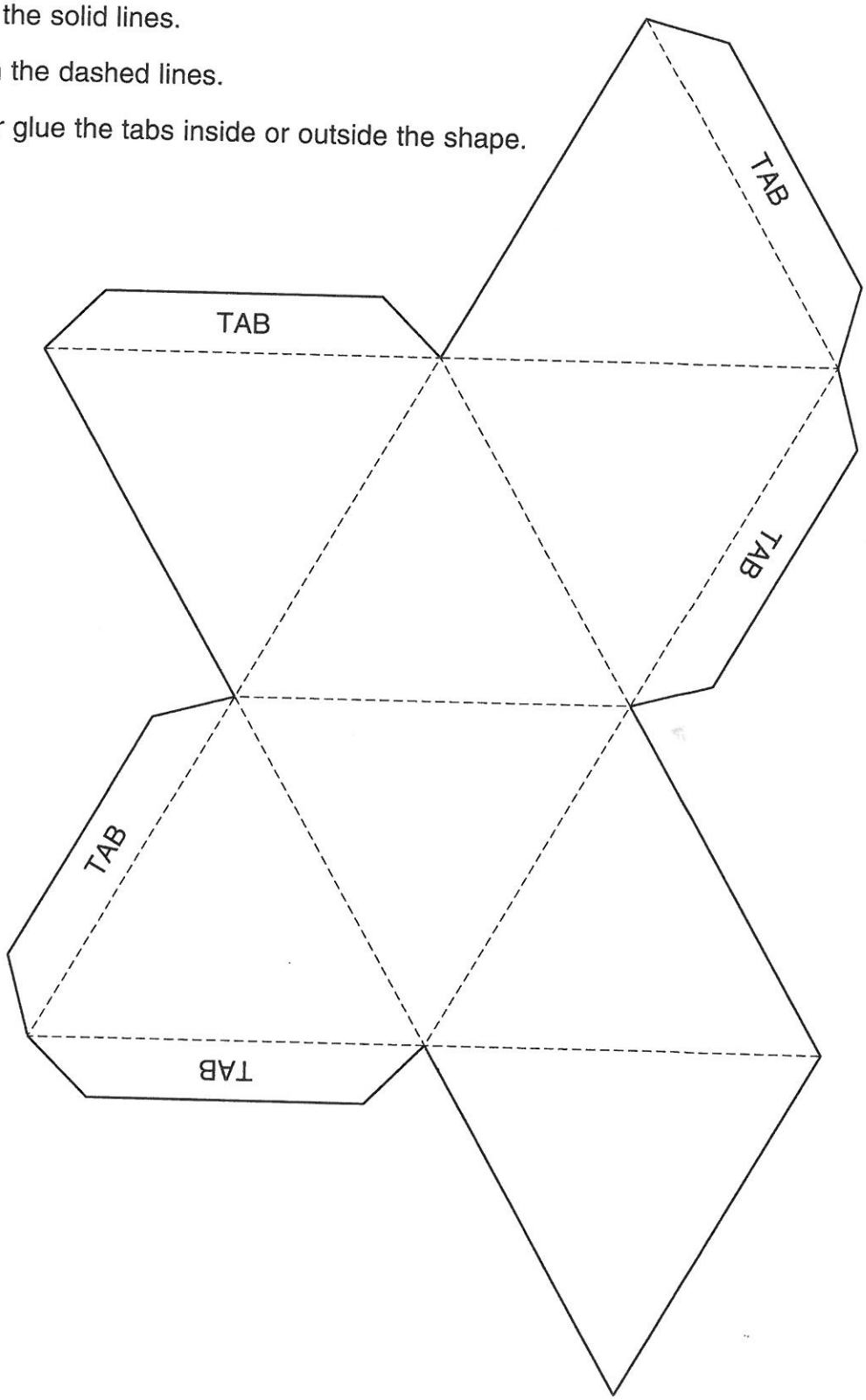
Name Date Time

LESSON 11•1

Octahedron Pattern

1. Cut on the solid lines.
2. Fold on the dashed lines.
3. Tape or glue the tabs inside or outside the shape.



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LESSON 11•2

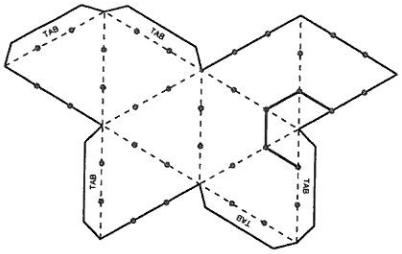
Exploring Truncated Polyhedrons

Truncated polyhedrons are formed by shortening the edges of the solid and cutting off the vertices. Follow the steps below to make models of an octahedron and a truncated octahedron.

Part 1: Octahedrons

1. Use a centimeter ruler to mark dots on the lines of the pattern on *Math Masters,* page 330 so that the lines are divided into thirds.

2. Use a colored pencil or marker to connect the dots to form triangles around the vertices of the octahedron.



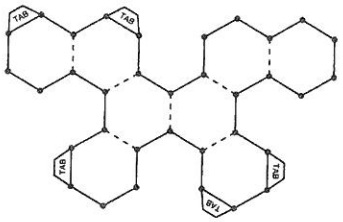
3. Cut out and assemble the octahedron model.

4. Hold the model so that a vertex is facing you. What shape is formed by the colored lines? _____

Part 2: Truncated Octahedrons

5. Repeat steps 1 and 2 with your second copy of the octahedron pattern.

6. Cut out the pattern. Then cut along the colored lines. You will cut off the vertices and parts of the tabs. Assemble the model.

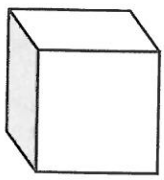


7. What two shapes are contained in the model?

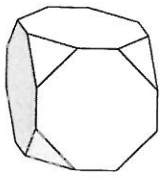
_____

8. What shapes are contained in a truncated hexahedron?

_____



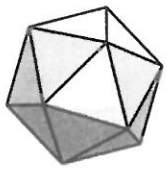
Hexahedron



Truncated Hexahedron

9. What shapes are contained in a truncated icosahedron?

_____



Icosahedron

Truncated Icosahedron

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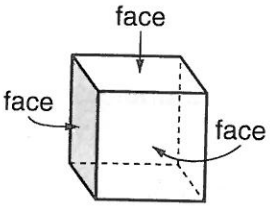
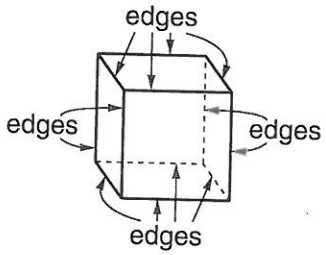
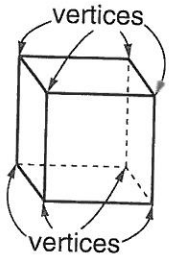
LESSON 11•1

Exploring Faces, Vertices, and Edges

- A flat surface of a geometric solid is called a face.
- A corner of a geometric solid is called a vertex. The plural of vertex is vertices.
- An edge of a geometric solid is a line segment or curve where two surfaces meet.





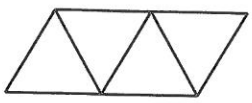


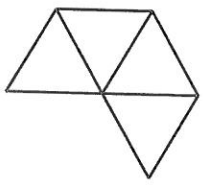
1. Complete the table.

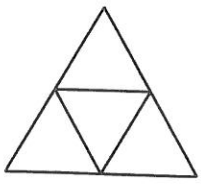
Polyhedron	Faces	Vertices	Faces + Vertices	Edges
Cube	6	8	6 + 8 = 14	12
Tetrahedron				
Octahedron				
Dodecahedron				
Icosahedron				

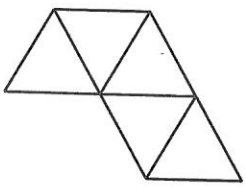
2. Compare the values in the Faces + Vertices column with the Edges column. What do you notice?

3. Two of the patterns below can be folded to make a tetrahedron. Cross out the patterns that will not make a tetrahedron. Circle the patterns that will make a tetrahedron. Explain your solution strategy.









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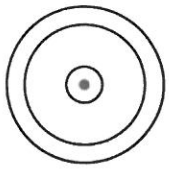
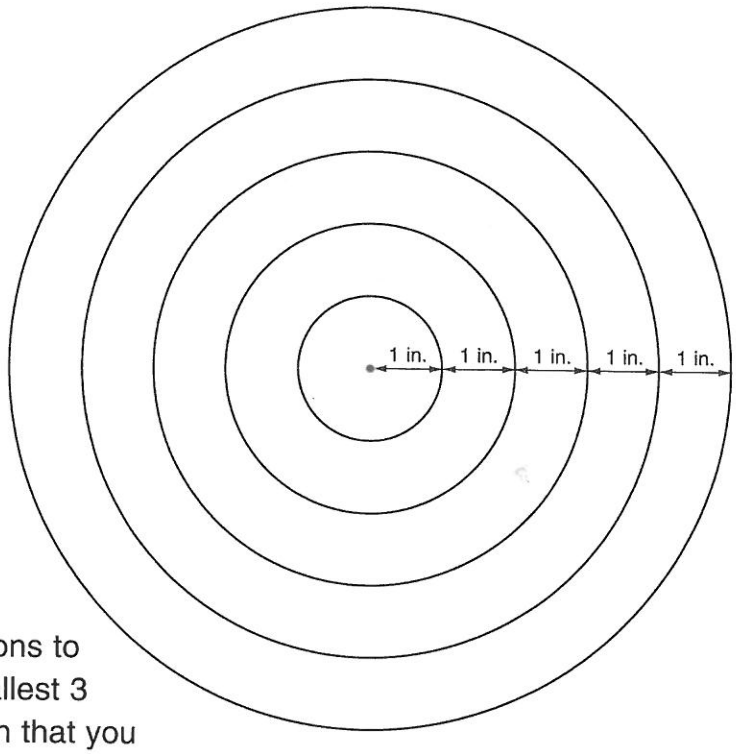
LESSON 11•4

Finding the Area of Concentric Circles

Concentric circles are circles that have the same center, but the radius of each circle has a different length.



The smallest of the 5 concentric circles below has a radius of 1 in. The next largest circle has a radius of 2 in. The next has a radius of 3 in. The next has a radius of 4 in., and the largest circle has a radius of 5 in. The distance from the edge of one circle to the next larger circle is 1 in.



1. Use colored pencils or crayons to shade the region of the smallest 3 circles red. Shade the region that you can see of the next circle yellow, and the region that you can see of the largest circle orange.

   Which region has the greater area, the red region or the orange region?

   _____

2. a. How can you change the distance between the circles to make the area of the yellow region equal to the area of the red region? Explain your answer on the back of this page.

   b. How can you change the distance between the circles to make the area of the yellow region equal to the area of the orange region? Explain your answer on the back of this page.

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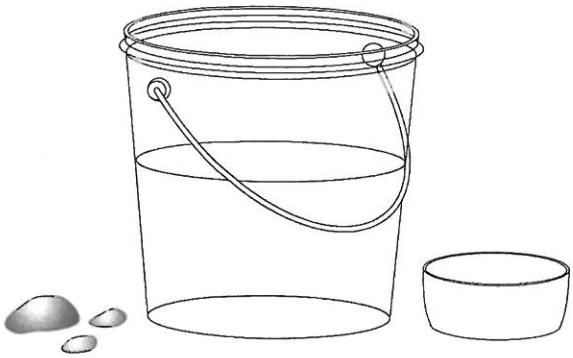
LESSON 11•5

A Boat and a Stone *continued*

2. Model the thought experiment, "A Boat and a Stone."

Materials

- ☐ bucket or clear container
- ☐ small container that floats and fits in the bucket or clear container with plenty of space all around
- ☐ several rocks
- ☐ water
- ☐ waterproof marker



Directions:

a. Fill the bucket part way up with water. Make sure the water is deep enough to cover the rock.

b. Place a rock in the small container, and float it in the bucket. If the small container sinks, try a smaller rock. If the small container tilts over into the water, try a larger rock.

c. After the water settles, mark the height of the water on the bucket with the marker. If your bucket is clear, mark the outside. If not, mark the inside wall. Also, mark the height of the water on the outside of the small container.

d. Take the rock out of the small container, and gently drop it into the water.

e. Describe the changes in the height of the water on the outside of the small container.

_____

_____

f. Describe the changes in the height of the water in the bucket.

_____

_____

_____

g. Do the changes agree with your thought experiment solutions? Why or why not?

_____

_____

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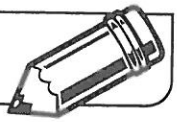
LESSON 11•7

A Surface-Area Investigation



In each problem below, the volume of a rectangular prism is given. Your task is to find the dimensions of the rectangular prism (with the given volume) that has the smallest surface area. To help you, use centimeter cubes to build as many different prisms as possible having the given volume.

Record the dimensions and surface area of each prism you build in the table. Do not record different prisms with the same surface area. Put a star next to the prism with the smallest surface area.

1.

Dimensions (cm)	Surface Area (cm^2)	Volume (cm^3)
$2 \times 6 \times 1$	40	12
		12
		12
		12

2.

Dimensions (cm)	Surface Area (cm^2)	Volume (cm^3)
		24
		24
		24
		24
		24
		24

3. If the volume of a prism is 36 cm^3, predict the dimensions that will result in the smallest surface area. Explain.

_____

_____

4. Describe a general rule for finding the surface area of a rectangular prism in words or with a number sentence. _____

_____

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LESSON 11•7

Volume and Surface Area of Solids

Area of rectangle: $A = l * w$

Area of triangle: $A = \frac{1}{2} * b * h$

Volume of rectangular prism: $V = B * h$

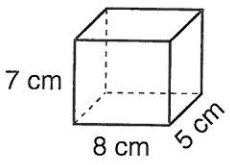
Circumference of circle: $c = \pi * d$

Area of circle: $A = \pi * r^2$

Volume of cylinder: $V = \pi * r^2 * h$

Record the dimensions, and find the surface area and volume for each figure below.

1. Rectangular prism



length of base = _____

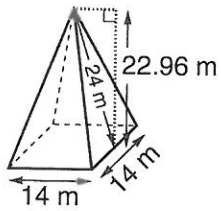
width of base = _____

height of prism = _____

Volume = _____

Surface Area = _____

2. Square pyramid



length of base = _____

width of base = _____

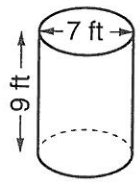
height of pyramid = _____

slant height = _____

Volume = _____

Surface Area = _____

3. Cylinder



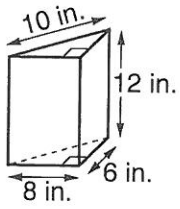
diameter = _____

height = _____

Volume = _____

Surface Area = _____

4. Triangular prism



length of base = _____

height of base = _____

length of hypotenuse = _____

height of prism = _____

Volume = _____

Surface Area = _____

Reminder: The hypotenuse is the side of a right triangle opposite the right angle.

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