Math 8
Filling & Wrapping
Study Guide

Name ______________________________

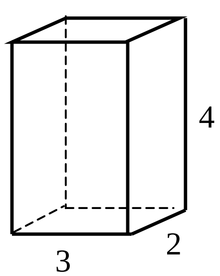
Date ____________________ Period ________

BIG IDEA #1

Develop the concepts of surface area and volume for a three-dimensional shape and explore strategies to measure and compute these values.

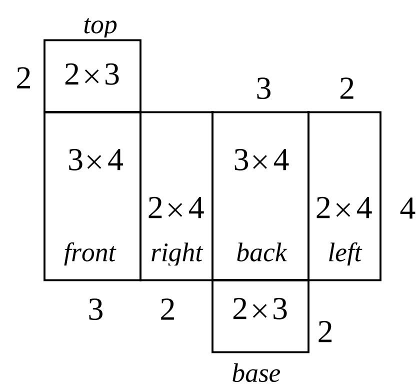
Boxes are **THREE-DIMENSIONAL OBJECTS** that have a characteristic called **VOLUME**, that is, they can be filled with a certain amount of liquids, gases or solids depending on their maximum **CAPACITY**. The capacity is often measured in **CUBIC UNITS**. For example, a box with dimensions $3cm \times 2cm \times 4cm$ has a volume of 24 cubic centimeters, also expressed as $24cm^3$.

A box can be unfolded into a **TWO-DIMENSIONAL FLAT PATTERN**, called a **NET**. The **SUM OF THE AREAS** of the faces of a net is called **SURFACE AREA**. **Surface area** is measured in **SQUARE UNITS**. In the case of the $3cm \times 2cm \times 4cm$ box from the preceding example, the surface area is 52 square centimeters, also expressed as $52cm^2$.

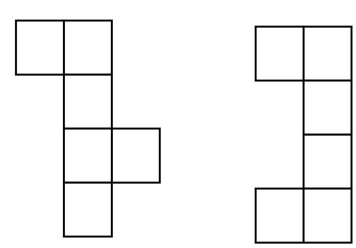


← Sketch of a 3-d rectangular prism

Sketch of a NET → for the same prism



A **CUBE** is a special box where all six faces are square and the same size. To the right are two flat patterns, one that can be folded into a cube, and one that cannot. Can you indentify the cubic "net" and explain why the other pattern will not work?



Your explanation:

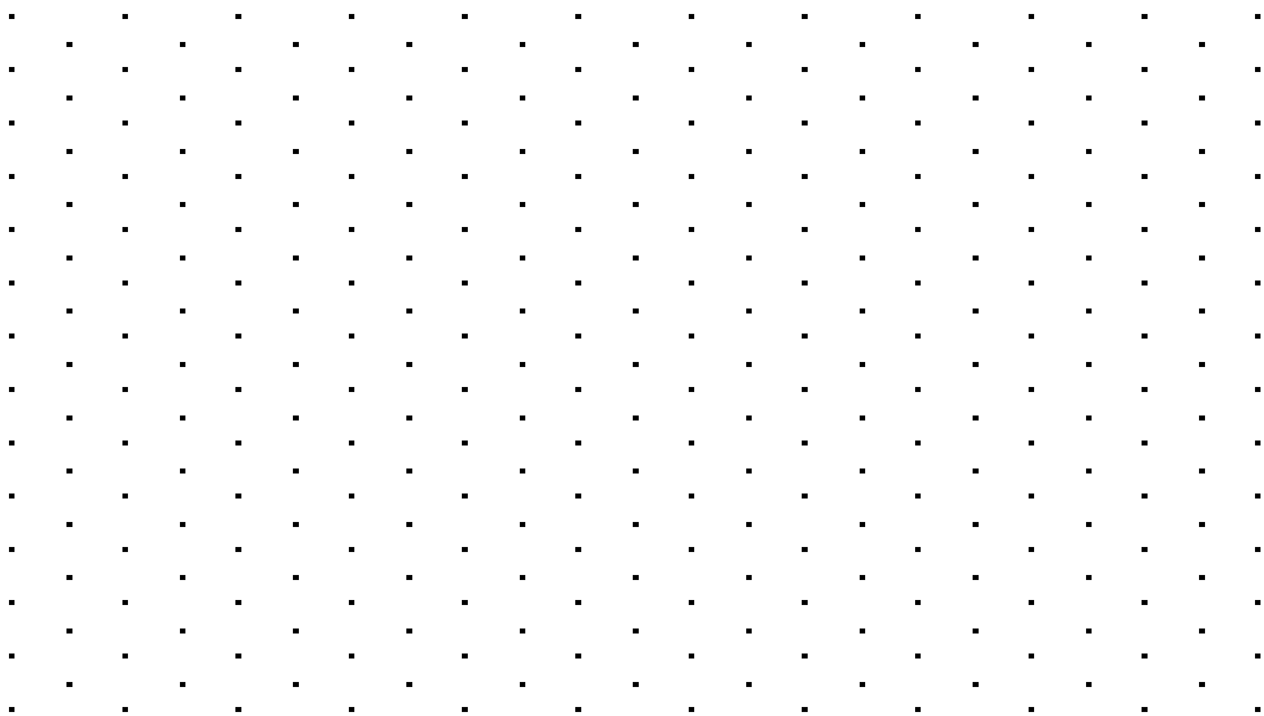
Vocabulary you should know:

1.	cone	A 3-D shape with a **circular end** and a **pointed end**.
2.	cube	A 3-D shape with six **IDENTICAL** square faces.
3.	cylinder	A 3-D shape with two opposite faces that are **congruent circles**. A rectangle (the side wall) is wrapped around the circular ends.
4.	edge	The line segment formed where two faces of a 3-D shape meet.
5.	face	A polygon that forms **one** of the flat surfaces of a 3-D shape.
6.	flat pattern	An arrangement of attached polygons that **can be folded** into a 3-D shape.
7.	prism	A 3-D shape with a top and a bottom that are **congruent polygons** and faces that are parallelograms.
8.	surface area	The area required to **cover** a 3-D shape. In a prism, it is the **sum** of all of the areas of all of the surfaces.
9.	radius	The distance from the center of a circle to any point on the circle.
10.	volume	The amount of space, or the **capacity**, of a 3-D shape. It is the number of unit cubes that will **fill** a 3-D shape.

BIG IDEA #2

Understand the concept that a box is more **EFFICIENT** *if it can hold the same volume using less surface area (or packaging material).*

Rectangular prisms with different shapes can hold the same volume. Draw the prisms specified below and compute their respective surface areas.



Prism A Dimensions: $1 \times 1 \times 12$	**Prism B** Dimensions: $1 \times 2 \times 6$	**Prism C** Dimensions: $2 \times 2 \times 3$
Front: ___ × ___ = _____ cm^2	**Front:** ___ × ___ = _____ cm^2	**Front:** ___ × ___ = _____ cm^2
Back: ___ × ___ = _____ cm^2	**Back:** ___ × ___ = _____ cm^2	**Back:** ___ × ___ = _____ cm^2
Top: ___ × ___ = _____ cm^2	**Top:** ___ × ___ = _____ cm^2	**Top:** ___ × ___ = _____ cm^2
Base: ___ × ___ = _____ cm^2	**Base:** ___ × ___ = _____ cm^2	**Base:** ___ × ___ = _____ cm^2
Left: ___ × ___ = _____ cm^2	**Left:** ___ × ___ = _____ cm^2	**Left:** ___ × ___ = _____ cm^2
Right: ___ × ___ = _____ cm^2	**Right:** ___ × ___ = _____ cm^2	**Right:** ___ × ___ = _____ cm^2
SURFACE AREA = _____ cm^2	**SURFACE AREA** = _____ cm^2	**SURFACE AREA** = _____ cm^2

BIG IDEA #3

Using formulas is most effective when you have a structured approach. Lab 5.1 (Vorple-Norple) detailed a structured top-down method for using formulas.

Use the method detailed in the example at right to maximize your success when working with formulas.

Steps to calculate the **PLOMP** of a **VORPLE**:

	(Write the generic formula)
$P = u + 2(b - w)$	(Substitute the values for b, w, and u)
$= 4 + 2(9 - 3)$	(Parentheses first)
$= 4 + 2(6)$	(Multiplication before addition)
$= 4 + 12$	(Last step: addition)
$P = 16$	

BIG IDEA #4

To find the volume of any right prism or cylinder, first find the **AREA OF THE BASE**, *then* **MULTIPLY BY THE HEIGHT**.

See your work in Labs 3.3 and 4.1B for examples.

BIG IDEA #5

Understand the relationship of the volumes of **CONES** *and* **SPHERES** *to cylinders of the same radius and height.*

See your work in Lab 5.2 for examples.

NOW, it's time to PREPARE for the Filling & Wrapping UNIT TEST.

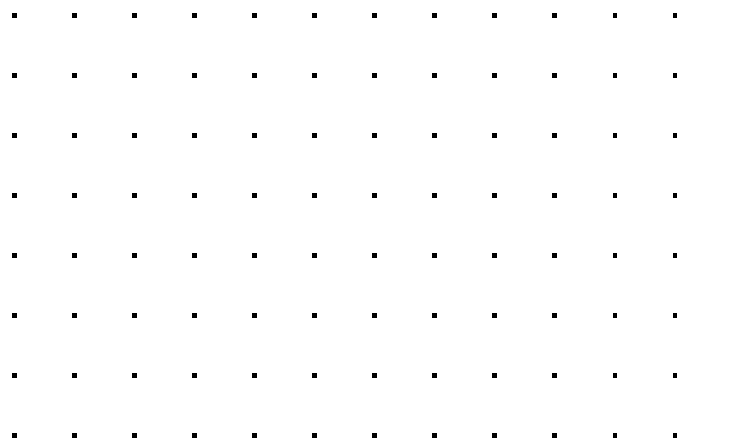
Work on the problems supplied in this packet. Draw pictures as required and SHOW ALL WORK. Got questions? Speak up in class or get on the BLOG!

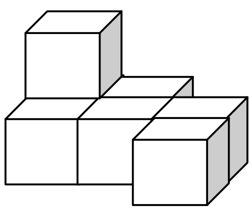
1. A cylinder has a volume of 120cm^3. What is the volume of a cone with the same radius and height?

2. On the square dot paper at right, draw the:

a) top view
b) front view
c) right side view

of the 3-D object pictured below:





.

d) What is the surface area of the 3-D object above (assume square centimeters)?

3. Write the volume formulas for a cylinder and a cone. Explain the relationship (compare & contrast). If you find it helpful, draw a picture.

4. a) Draw a rectangular prism with the following ***l*** x ***w*** x ***h*** dimensions: 2 x 3 x 8.

b) Calculate the Volume (show all work):

c) Calculate the Surface Area (show all work):

d) Give the dimensions of another box that would hold the same volume but has **less surface area**:

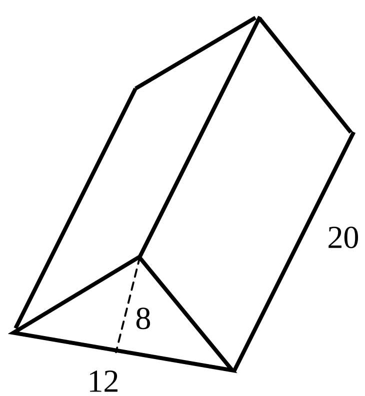
e) Give the dimensions of another box that would hold the same volume but has a **greater surface area**:

5. A cylinder has a radius of 6 inches and a height of 10 inches.
Sketch a generic drawing (not to scale) and label a picture of the cylinder.

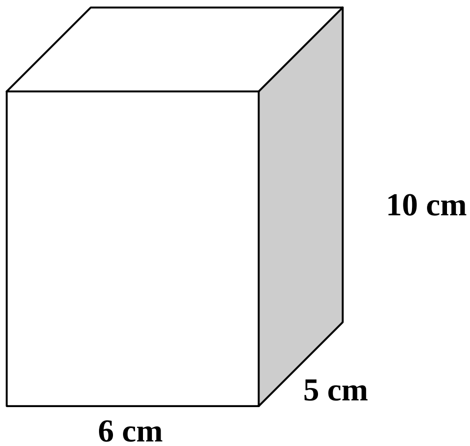
a) Sketch

b) Calculate the Volume

6. Find the volume of the triangular prism pictured below:

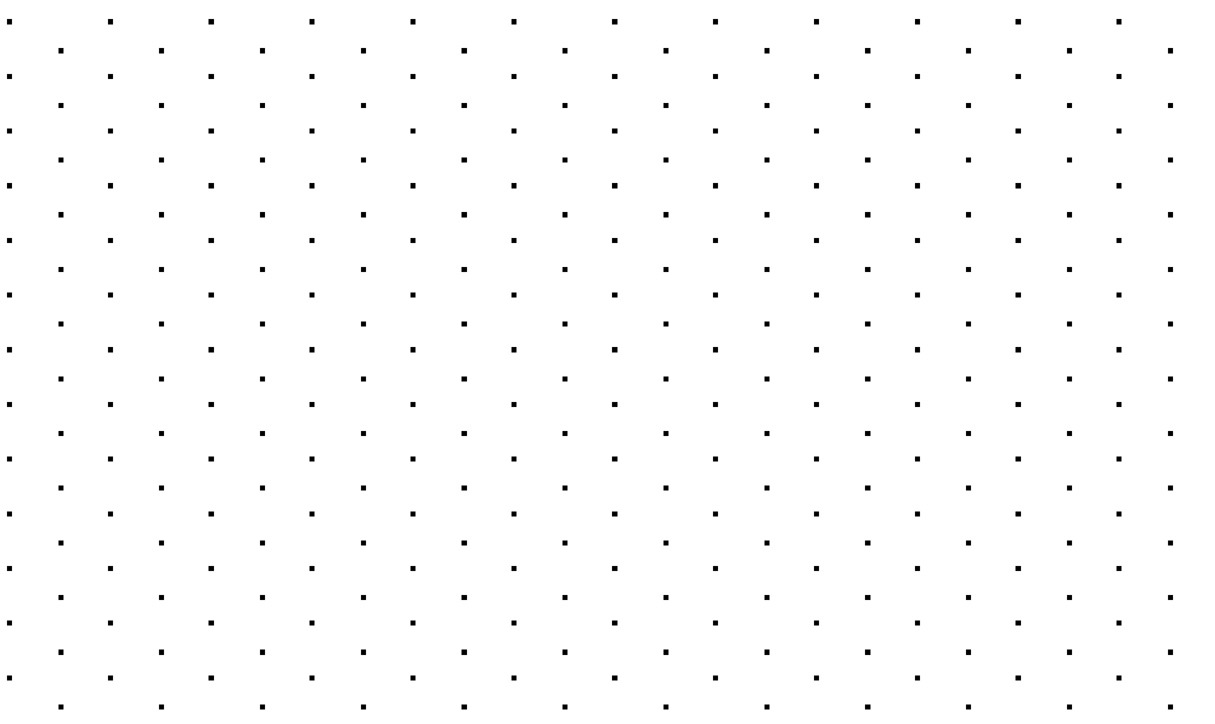


7. a) What is the volume of the rectangular box pictured below?



b) Identify possible dimensions for a rectangular box with twice the volume:

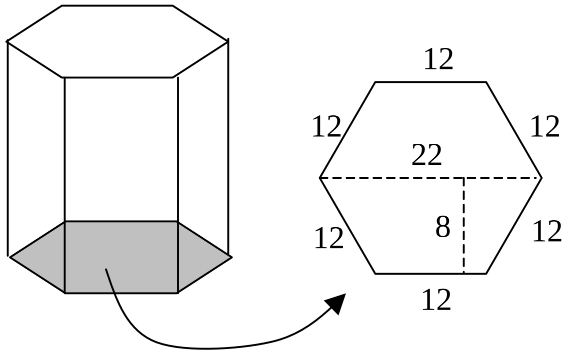
c) A box with one-tenth the volume of the box in #17 (above) has a height of 2 centimeters. Identify possible dimensions of this box. Draw this box on the isometric dot paper below.



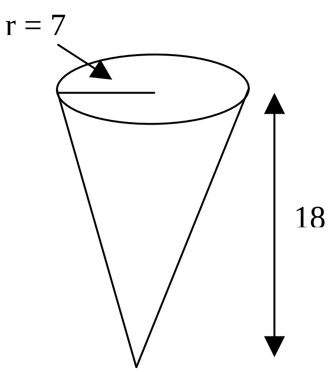
Find the volumes of the containers below. **SHOW ALL WORK!**
(round decimals to hundredths)

All units in ***centimeters*** *(figures not drawn to scale)*

8)



9)



10)