'Geometrics Project' - Day 2

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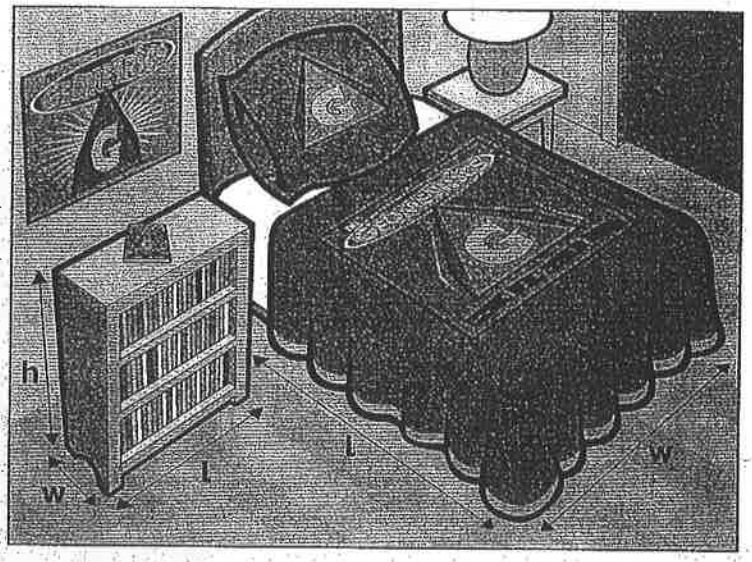
Covering Up



You can use the same skills at home that the Geometrics Stage Crew uses to do their job. Figuring out surface area can help you do things like paint objects or calculate how much fabric is needed to cover a bed. **Solve the hypothetical exercises below to see how surface area formulas might be used at home.**

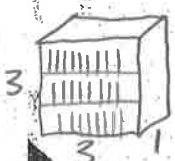
FEATURED FORMULAS

Surface Area of 3D Shapes:

Rectangular Prism: $SA = 2 \cdot (l \cdot w + l \cdot h + w \cdot h)$

Cone: $SA = (\pi \cdot r^2) + (\pi \cdot r \cdot \text{slant})$

1 **You have a CD rack at home, which is a rectangular prism that measures 3 feet long by 3 feet high with a width of 1 foot. How many square feet would you be painting to cover the two sides, the top, and the back?**

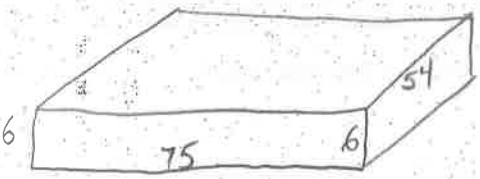


$A_{painted} = 2\times(1)(3),\ 1\times(1)(3),\ 1\times(3)(3)$
(2 sides), (top) (back)

$= 6 + 3 + 9 = \boxed{18\ ft^2}$

2 **The Geometrics Stage Crew is selling cover sheets for beds that have the band's logo on them. A full-size mattress measures 54 inches wide by 75 inches long by 6 inches high. If the sheet were to cover all but the bottom of the mattress, what is the minimum total surface area? State your answer in square feet.**

$in^2 \longrightarrow ft^2$, ÷ by 144!



$A = 2(6)(54) + 2(6)(75) + 1\times(75)(54)$
(2 sides) + (2 other sides) + (top)

$= 648 + 900 + 4050$

$= 5598\ in^2 \div 144 = \boxed{38.9\ ft^2}$

NOW TRY THIS: **At Geometrics shows, some fans wear cone-shaped hats because of the band's fondness for shapes. You decide to join in and paint a birthday hat you have at home. You have a 1-ounce jar of gold paint, which will cover about 33 square inches. You have a hat with the measurements of d = 4 inches and slant = 7 inches. Do you have enough paint to cover the hat? To figure this out you need to use the formula for the surface area of a cone: $SA = (\pi \cdot r^2) + (\pi \cdot r \cdot \text{slant})$. Hint: You don't need the $(\pi \cdot r^2)$ part of the formula because that's the open circle part that will fit on your head.**

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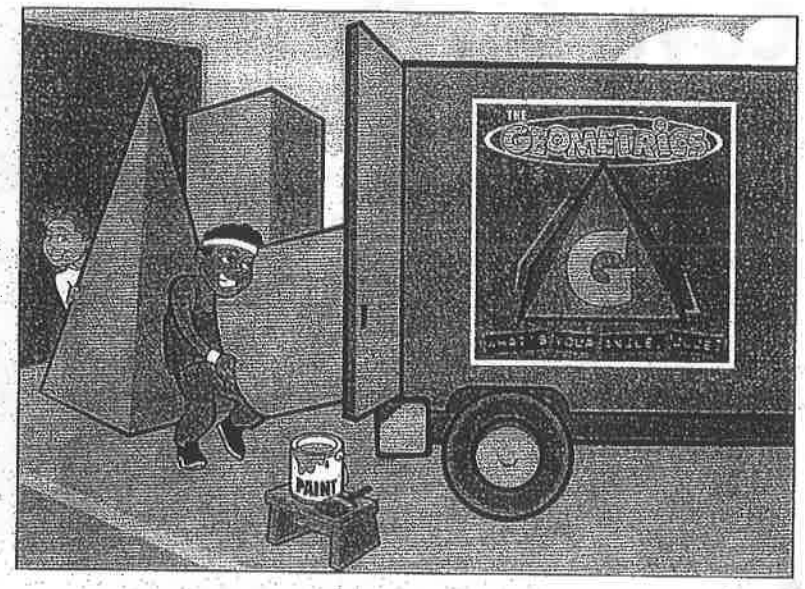
Pack It Up!
What Will Fit?

The Geometrics Stage Crew now has to transport the painted props of a rectangular prism, a cylinder, and a square pyramid to the concert. They have to make sure the van they have is big enough to carry the props. To do this, they are going to measure the volume of the cargo space and compare that to the volume of the three objects they have.



THE DIMENSIONS OF THE OBJECTS AGAIN ARE:

Rectangular Prism: height = 7 feet, width = 4 feet, and length = 3 feet

Cylinder: radius = 3.5 feet and height = 7 feet

Square Pyramid: base length = 4, base width = 4, a slant height of 7.28 feet, and a height of 7 feet

1 First, get the complete volume of all the objects combined.

a. What is the volume of the rectangular prism? $V = LWH = (3)(4)(7) = 84\ ft^3$

b. What is the volume of the cylinder? (Give the decimal answer and then round it to the nearest cubic foot.) $V = \pi r^2 h = \pi(3.5)^2(7) = 269\ ft^3$

c. What is the volume of the square pyramid? $V = \frac{LWH}{3} = \frac{(4)(4)(7)}{3} = \frac{112}{3} = 37\ ft^3$

d. What is the total volume of all the objects combined, rounded to the nearest foot? $84 + 269 + 37 = 390\ ft^3$

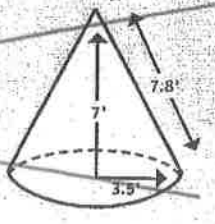
2 The van cargo space measures 8 feet tall by 5 feet wide by 13 feet deep. What is the volume of the cargo space?

$V_{rect.\ prism} = LWH = (8)(5)(13) = 520\ ft^3$

3 Based on the volume measurements, can you estimate if the objects will fit in the van?

$V_{van} = 520\ ft^3$, $V_{objects} = 390\ ft^3$ ... there is enough room, and the objects should fit!

BONUS: **Based on volume, would there still be room for the cone from the bonus section of Worksheet 2? The radius of the cone = 3.5 feet and height = 7 feet and slant = 7.8 feet. To calculate the volume (cubic measurement) of the cone, you need to learn a new formula: $V = \pi \cdot 1/3 \cdot r^2 \cdot h$.**



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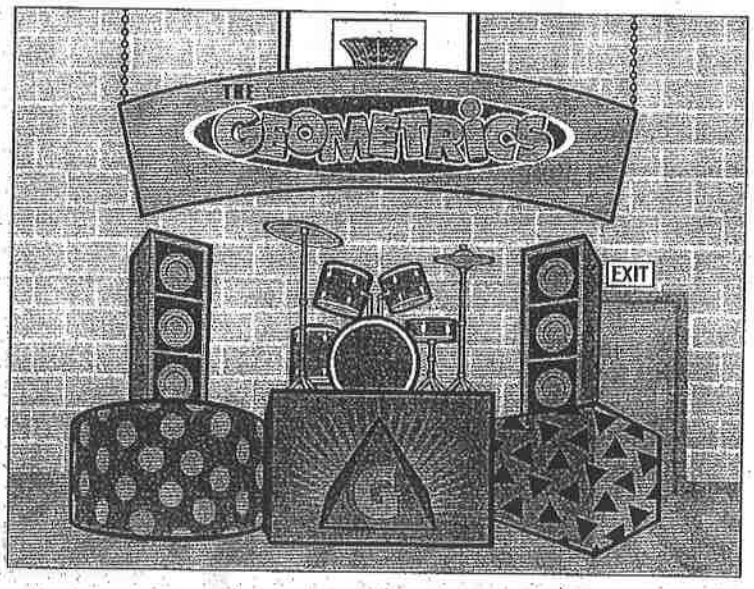
Turn Up the Volume!

The Geometrics like to play loud. Using volume formulas, the Geometrics Stage Crew can tell them how loud they can play.



1 The Geometrics decide to play a concert in the gym. The gym measures 100 feet long by 60 feet wide by 30 feet tall. The band asks the stage crew how loud they can play in this gym. After some experimenting, the stage crew calculates that the band can turn up their amplifier volume one notch for every 18,000 cubic feet. **So how loud can The Geometrics have their amplifiers in this room?**

$V_{room} = V_{prism} = LWH = (100)(60)(30) = 180{,}000\ ft^3$, $\frac{180{,}000}{18{,}000} = 10$ notches

2 The gym can fit 1.200 people. How many square feet of floor space per person? Based on this answer, how big would the gym floor have to be to accomodate 1500 people, the usual attendance at a Geometrics concert?

$A_{floor} = L \times W = (100)(60) = 6{,}000\ ft^2$, $\frac{6000}{1200\ ppl} = 5\ ft^2/person$

For 1500 people, $5 \times 1500 = 7500\ ft^2$ would accomodate 1500 people

3 The Geometrics Stage Crew finds another gym at a nearby school to put on the show. It has a floor area of 8,000 square feet and a total volume of 280,000 cubic feet. **How tall is the ceiling?**

$V = L \times W \times H$, or, $V = (\text{area of floor}) \times H$

so... $280{,}000 = (8000) \times H$

now, solve for H!

$\frac{280{,}000}{8000} = \frac{8000H}{8000}$

$H = 35\ ft$

4 ~~The Geometrics Stage~~ Crew creates a huge hologram of the band's square pyramid logo ~~that they can project into the audience. They want the projected pyramid to look like it's resting on the floor, with its peak touching the 30-foot-high ceiling. The band also wants the volume of the pyramid to be 6,250 cubic feet. Based on these numbers, how long would one side of the pyramid's base be?~~

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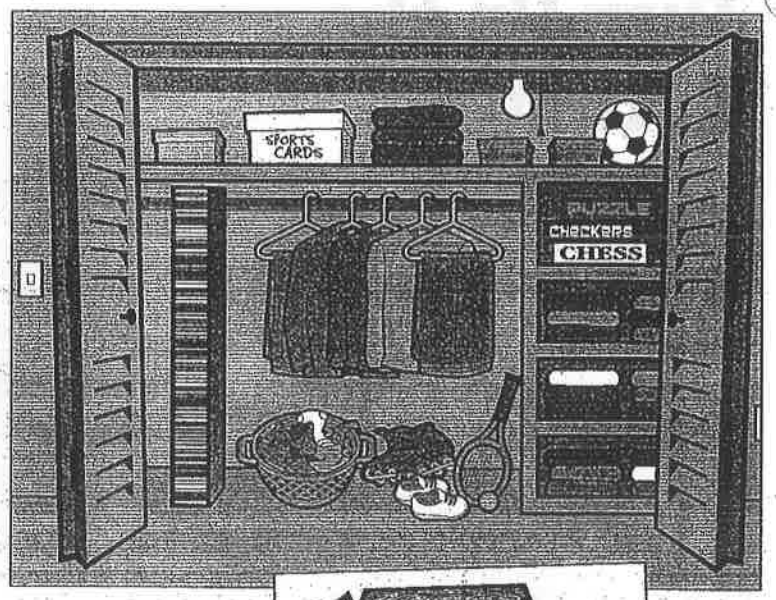
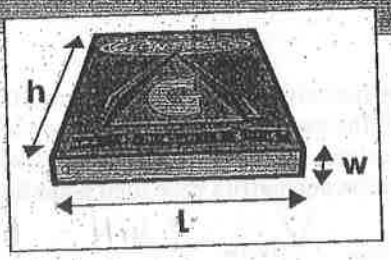
The Perfect Fit



Just like the Geometrics Stage Crew used volume measurement to fit props in a van, you can apply volume measurement in and around your home. For example, volume can help you make sure you have enough room for all your stuff. Try the exercises below to see how it works.

FEATURED FORMULAS

Volume of 3D Shapes:
Rectangular Prism: $V = l \cdot w \cdot h$
Cylinder: $V = \pi \cdot r^2 \cdot h$



1 **You have a CD collection and want a CD tower that will hold all of your CDs. If the average CD measures about 6 inches long by 5 inches high by 1/4 (.25) inches wide, and you have 80 CDs, what should the minimum volume of your CD rack be? You may want to use the conversion chart in the back of your workbook to calculate the ~~cubic feet and~~ cubic inches. Note: You'll need a calculator to figure out your answer.**

$V_{one\ CD} = LWH = (6)(5)(0.25) = 7.5\ in^3$

$V_{80\ CD's} = 80 \times 7.5 = 600\ in^3$

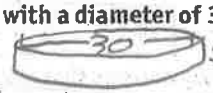
$V = 600\ in^3$

2 **To experiment more with cubic measurement, find out the volume of your bedroom and closet, if your bedroom is 15ft × 12ft × 7ft and your closet is 5ft × 3ft × 7ft.**

Bedroom volume: (rect. prism) $V = LWH = (15)(12)(7) = 1260\ ft^3$

Closet volume: (rect. prism) $V = LWH = (5)(3)(7) = 105\ ft^3$

3 **Volume is also great for measuring liquid. You may be able to figure out how much water a pool holds by getting its length, width, and depth. The general rule is 1 cubic foot = 7.48 gallons. Assume your neighbors have a big, perfectly round pool with a diameter of 30 feet and a depth of 5 feet. How much water would that pool hold?**



so, $r = 15\ ft$ $V = \pi r^2 h = \pi(15)^2(5) = 3,532.5\ ft^3$ $3,532.5 \times 7.48 = 26,423$ Gallons

NOW TRY THIS: **You have a can of juice and want to find out how tall it is by using its radius and its volume. Assume you pour the juice into a measuring glass and find that the can holds 12.1 ounces of juice. If .55 ounces = 1 cubic inch, then 12.1 ounces = 22 cubic inches. Your can has a volume of 22 cubic inches and a diameter of 2 inches. Using the cylinder formula on this page, calculate the height of the can rounded to the nearest inch. Note: You'll need a calculator to figure out your answer.**