my key

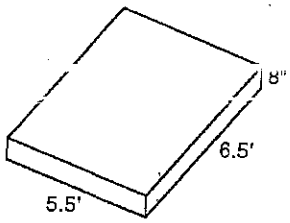
4. The volume of a cylinder is 628 cm^3. Find the radius of the base if the cylinder has a height of 8 cm. Use 3.14 for π.

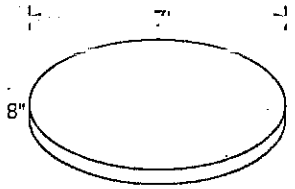
EXERCISE SET C

In this set of exercises, you will need the following information:

- Water weighs about 63 pounds per cubic foot.
- A cubic foot of water is about 7.5 gallons.

1.* A king-sized waterbed mattress measures 5.5 feet by 6.5 feet by 8 inches deep. How much does the water in this waterbed weigh to the nearest pound?





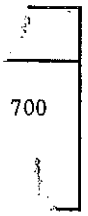
(5.5)(6.5) $\frac{8}{12}$

23.83 cuft.

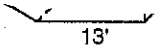
Weight x 63 ≈ 1501.5lb

gal 23.83 x 7.5

179 gal



many gallons of water can the pool hold?



$\pi(3.5)^2\left(\frac{8}{12}\right)$

25.7 cuft

Weight 25.7(63)

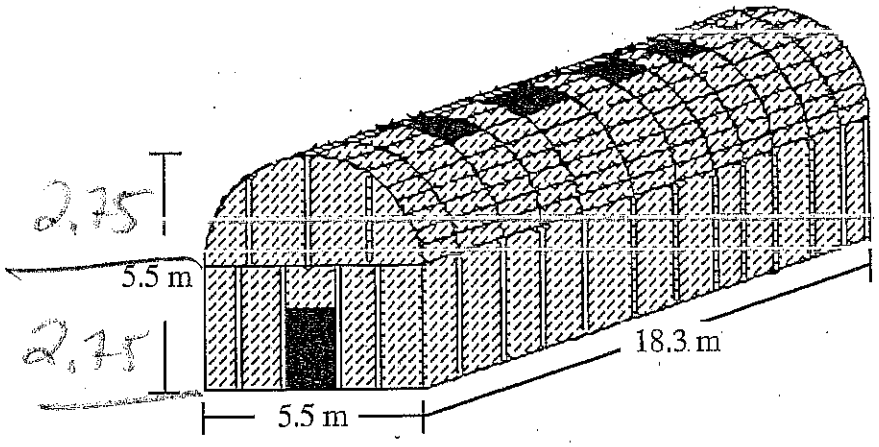
1616 lb.

gal 25.7(7.5)

193 gal

Surface Area and Volume Problems

2.6 The Iroquois Indians of New York lived in rectangular barrel-roofed houses. The roof of each structure was made by bending poles into a semicircular shape (a half barrel). The entire building, except for the floor, was covered with bark. How much tree bark would be needed to cover the house shown in the diagram below?



* * * * * * * * * *

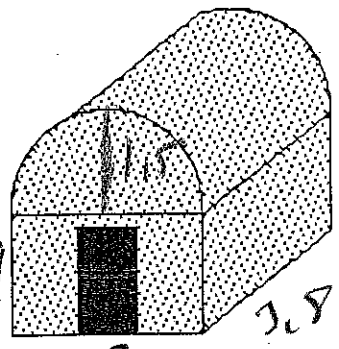
Identify the geometric shapes / solids

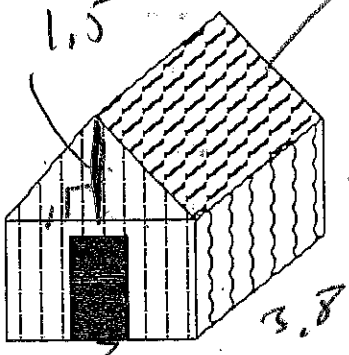
Show the set-ups for each calculation

Rectangles $2(2.75)(5.5)$ + $2(2.75)(18.3)$ = 30.25 + 91.5 = 121.75 sq. m.

$\frac{1}{2}$ Lateral SA of cylinder $\frac{\pi(5.5)(18.3)}{2}$ = 158.1 sq. m. (260 sq. m.)

3.4 The basic shapes of the two structures shown below were used by many different American Indian tribes.





Consider a structure of each type with identical, rectangular bases measuring 3.0 m by 3.8 m. Each structure has walls of the same height, as well as the same overall height, 3.4 m.

a. Which structure has the greater surface area? Explain your response.

b. Which has the greater volume? Explain your response.

c. If the two structures were built of the same materials, which one would you expect to retain heat more efficiently? Explain your response.

(a)

2(1.9)(3) = 11.5 flat is the same for both

2(1.9)(3.8) = 14.44 = Sum = 25.94

Round Top

1 circle $\pi(1.5)^2 = 7.1$

Lateral

$\frac{1}{2}\pi(3)3.8 = 17.9$

TOTAL S.A. = 25.94 + 7.1 + 17.9

50.94 S.A. greater ✓

Triangular

2 @ $\frac{1}{2}(3)(1.5) = 4.5$

2 rectangle $\sqrt{9.5}(3.8) = 16.2$

25.94 + 4.5 + 8.1 x 2

46.64

(b)

$\frac{1}{2}$ circle = $\frac{7.1}{2} \rightarrow 3.6$

Rect. 3(1.9) = 5.7

9.3(3.8) = 35.34 cum.

Greater ✓

$\frac{V}{SA} = \frac{50.94}{35.34} = 1.44$

1 Δ $\frac{4.5}{2} \rightarrow 2.25$

+ Rect. 3(1.9) = 5.7

7.95(3.8) = 30.21 cum

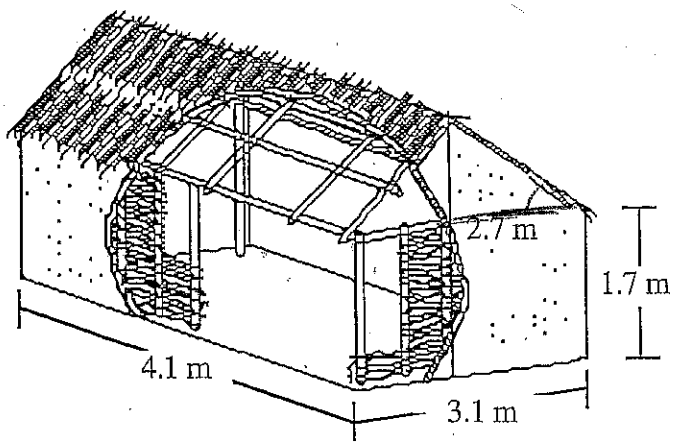
$\frac{46.64}{30.21} = 1.54$

Activity 3

Like today's families, early American Indian families lived in dwellings of various shapes and sizes. The ease of heating and cooling these structures was an important part of their design. Efficient heating and cooling are also major considerations for nearly all modern homes.

Since you heat the space inside a home (volume) and lose heat through the outside walls, roof, and floor (surface area), you must consider both surface area and volume when estimating efficiency. One way to do this involves calculating the ratio of a building's surface area to its volume. Although this rule of thumb is not always applicable, it does give one indication of a home's potential efficiency.

3.3 The summer houses of one Southeastern tribe were rectangular, gabled dwellings with thatched roofs and mud walls. The gabled roof was open, with smoke holes located along the ridge. One example of this type of house is shown in the diagram below.



a. What is the volume of this house?

b. What is its ratio of surface area to volume?

2,7
-1,7
1,2 33°
3,1

$\frac{1}{2}(3.1)(2)$

$3.1(1.7)$

(a)

3.1
5.3
8.4(4.1)
34.44 m

SA

$\sqrt{1.55^2+?^2} = 2.53$

1,55 1,55

Thatched Roof 2@(2.58)(4.1) 20.7

Side Wall 2@(4.1)(1.7) = 13.94

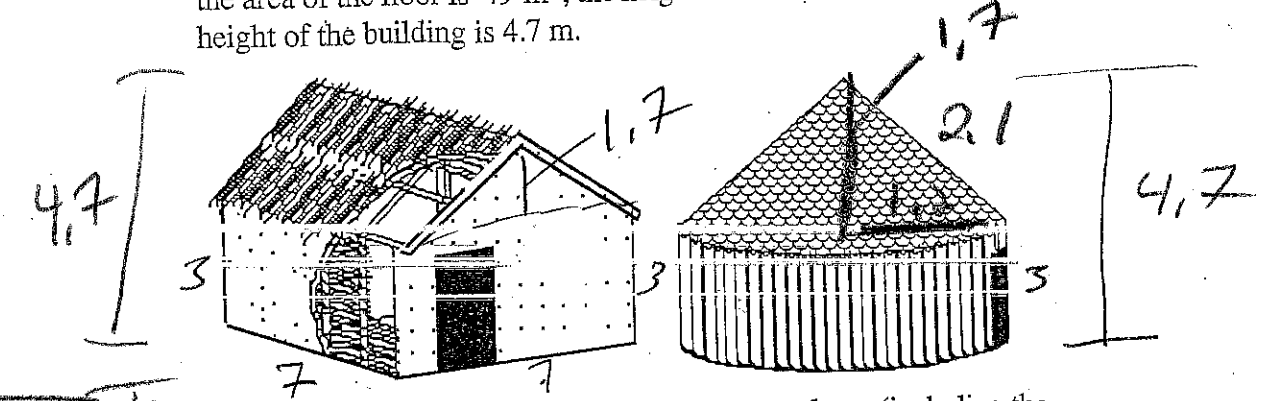
Ends 8.4 × 2 = 16.8

20.7+13.94+16.8 = 51.54 m

ratio 34.44 / 51.5

SA 51.5 / 34.44 ≈ 1.5

3. Oklahoma's Delaware tribe did not build roundhouses. Their ceremonial lodges were shaped like square prisms with gabled roofs. In the diagram below, a Delaware lodge is shown on the left, while a Miwok roundhouse appears on the right. For both of these structures, the area of the floor is 49 m^2, the height of the walls is 3 m, and the total height of the building is 4.7 m.



1.7, 3.5, $\sqrt{1.7^2+3.5^2}$ = 3.9

a. Compare the ratios of total surface area to volume (including the floor) for the two buildings.

b. If you lived in a region where building materials were scarce, which type of structure would you choose: the roundhouse or the gabled lodge? Explain your response.

c. Which design might be easier to heat or cool? Explain your response.

Delaware

SA $4(3)(7) = 84$

$2 @ \frac{1}{2}(7)(1.7) = 12.9$

Roofs $3.9(7)2 = 54.6$

148.5 sq m

Volume $(3(7) + \frac{12.9}{2})7$

262.15 m^3

SA/Vol $\frac{148.5}{262.15} \approx .7$

Miwok $A = 49$

$\pi r^2 = 49$

$r^2 = \frac{49}{\pi}$

$r = \sqrt{\frac{49}{\pi}}$ 1.2

$D = 2.4$

Conical Roof $\pi(1.2)(2.1)$

7.9

Lateral $\pi(2.4)3$

22.6

Vol 7.9 + 22.6

Cone $\frac{1}{3}(49)1.7$

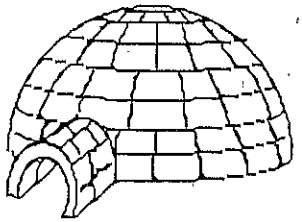
Cyl. $49(1.7)$

= 111.1

30.5

$\frac{30.5}{111.1} \approx .3$

5.6 The diagram below shows one example of an igloo. The inside diameter of the igloo is 6.0 m, while its walls are made of packed snow 0.1 m thick.



a. The living space inside this igloo is a hemisphere. What is the volume of the living space?

b. What is the volume of the packed snow in the igloo's walls (ignoring the entryway)?

c. What is the ratio of lateral surface area to volume for the inside of the igloo? What might this ratio tell you about the relative heating efficiency of an igloo?

d. Consider a house built in the shape of a half cylinder (such as a Quonset hut) with the same volume as the igloo in Part **a** and a height of 3 m. Disregarding the floor, what is this home's ratio of surface area to volume?

e. Which shape—a hemisphere or a half cylinder—do you think would be more practical for housing in Arctic regions? Explain your response.

(a) $\frac{4}{3}\pi(3)^3 = 36\pi\ m^3 = 113.1\ m^3$

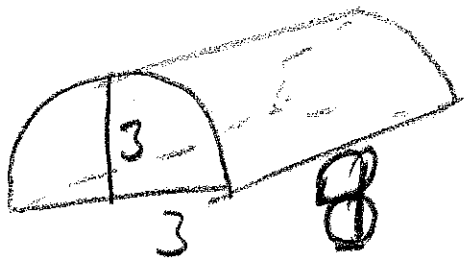
$\frac{4}{3}\pi(3.1)^3 = 124.8\ m^3$

(b) Snow $124.8 - 113.1 = 11.7\ m^3$

(c) Surface Area $\frac{1}{2}4\pi(3)^2 = 56.5$ sq m.

$\frac{56.5}{113.1} \approx 0.5$

(b)



$\pi(3)^2 h = 113.1$

$\frac{9\pi h}{9\pi} = \frac{113.1}{9\pi}$

$h = 8$

$S.A = \frac{1}{2} 6\pi$

$\frac{\pi D H}{2}$

$\frac{\pi(6)8}{2}$ 24π

+ 1 circle 9π

24π

9π

33π

104 sq in

$\frac{104}{113.1} \approx 0.9$

Igloo b/c lower ratio of SA/vol

so figure - - - ✓