12-6 Word Problem Practice

Surface Area of Cylinders

1. **MANUFACTURING** The Acme Canning Company produces cans for chicken soup. If each can has a diameter of 2 inches and a height of $3\frac{1}{4}$ inches, how much aluminum is needed to make one can? Round to the nearest hundredth.

2. **PLASTICS** A factory makes plastic barrels. The barrels have a diameter of 2.25 feet and a height of 3 feet. The plastic used to make them costs $2.60 per square foot. What would be the cost of the plastic to make 10 barrels?

3. **AGRICULTURE** A farmer has a silo with a volume of 2491.6 cubic feet. The silo is 24 feet tall. Find the surface area of the silo.

4. **STORAGE** Rachel has a can with a diameter of 3 inches and a height of 5.75 inches. She has another can with a diameter of 5 inches and a height of 3.25 inches. Which can has the greater surface area? Explain.

5. **SHIPPING** FPS, a shipping company, uses a container in the shape of a triangular prism to pack blueprints, posters, and other items that can be rolled up to fit inside the container. Packages-R-Us uses a container shaped like a cylinder for the same purposes. The cardboard used to make each container costs the same amount per square inch.
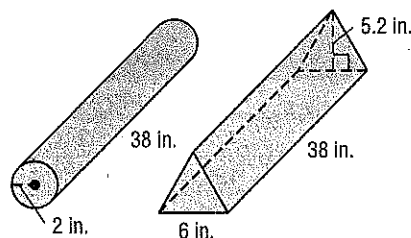
a. What is the surface area of the FPS box?

b. What is the surface area of the Packages-R-Us box?

c. If each company buys 100 of these packages, which company will spend less money per package? Explain.

12-6 Enrichment

Surface Area of Cylinders

Minimizing Surface Area In manufacturing, the packaging for a product is often designed to minimize cost. One way to do this is to get the most volume using the least amount of materials. Suppose you worked for a food canning company. You need to make a can with a volume of about 125 cubic inches using the least amount of aluminum. In other words, you need the can with the least surface area and a volume of 125 cubic inches. You can make a table to find the can which meets these criteria. Select various whole number heights, find the radius which would result in the desired volume, and then calculate the surface area.

Height (in.)	Volume Formula $V = \pi r^2 \times h$	Radius (in.)	Surface Area $SA = 2\pi rh + 2\pi r^2$
1	$125 = 3.14(r^2)1$	6.3	288.8 in²
2	$125 = 3.14(r^2)2$	4.5	183.69 in²
3	$125 = 3.14(r^2)3$	3.6	149.2 in²
4	$125 = 3.14(r^2)4$	3.2	144.7 in²
5	$125 = 3.14(r^2)5$	2.8	137.2 in²
6	$125 = 3.14(r^2)6$	2.6	140.4 in²
7	$125 = 3.14(r^2)7$	2.4	141.7 in²

According to the table, the cylinder with a height of 5 inches and a radius of 2.8 inches would have the least surface area.

Exercises

1. Make a table to find the least surface area for a cylindrical container with a volume of 60 cubic inches.

Height (in.)	Volume Formula $V = \pi r^2 \times h$	Radius (in.)	Surface Area $SA = 2\pi rh + 2\pi r^2$
1	$60 = 3.14(r^2)1$		
2	$60 = 3.14(r^2)2$		
3	$60 = 3.14(r^2)3$		
4	$60 = 3.14(r^2)4$		
5	$60 = 3.14(r^2)5$		

2. What do you notice about the diameter and the height of each of the cylinders with the least surface area? Describe the cylinder for any given volume that will have the least surface area.