

Minimizing Surface Area

A spreadsheet can be used to find the minimum surface area of a solid with a given volume.

► EXPLORING THE CONCEPT

A canned goods manufacturer needs to design a cylindrical container with a volume of 72 cm^3 . To use the least amount of material, the dimensions of the container must be chosen so the surface area is a minimum. Find the dimensions.

The dimensions you must find are the radius and the height for the given volume. You can vary the radius and find the resulting height and surface area. A spreadsheet is helpful in organizing the data.

► USE A SPREADSHEET

- 1 Make a table with four columns. The first column is for the given volume. Cell A2 stores the volume V . In cell A3, use the formula $=A2$.
- 2 The second column is for the radius. Cell B2 stores the starting value for the radius r . In cell B3, use the formula $=B2+0.05$ to increase the radius in increments of 0.05 centimeter.
- 3 The third column is for the height. In cell C2, use the formula $=A2/(PI()*B2^2)$. Your spreadsheet might use a different expression for π .
- 4 The fourth column is for the surface area. In cell D2, use the formula $=2*PI()*B2^2+2*PI()*B2*C2$.

	A	B	C	D
1	Volume V	Radius r	Height $h = \frac{V}{\pi r^2}$	Surface area $SA = 2\pi r^2 + 2\pi rh$
2	V	r	$= A2/(PI()*B2^2)$	$= 2*PI()*B2^2 + 2*PI()*B2*C2$
3	$= A2$	$= B2 + 0.05$	$= A3/(PI()*B3^2)$	$= 2*PI()*B3^2 + 2*PI()*B3*C3$

- 5 Fill in Cells C3 and D3 as shown above. Then use the Fill Down feature to create more rows. Replace the V in cell A2 with 72 and replace the r in cell B2 with 2. Your spreadsheet should resemble the one below.

	A	B	C	D
1	Volume V	Radius r	Height $h = \frac{V}{\pi r^2}$	Surface area $SA = 2\pi r^2 + 2\pi rh$
2	72	2.00	5.73	97.14
3	72	2.05	5.45	96.60
4	72	2.10	5.20	96.32

► MAKE A CONJECTURE

1. From the data in your spreadsheet, which dimensions yield a minimum surface area for the given volume? Explain how you know.

STUDENT HELP



Visit our Web site www.mcdougallittell.com to see instructions for several software applications.