

# Optimal Can Design

Your task is to design a one-liter ( $1,000 \text{ cm}^3$ ) can in the shape of a right circular cylinder. What dimensions will use the least amount of material?

Simplifying assumption: The amount of material is proportional to the (surface) area of the cylinder.

How to Solve It	Solution
<b>Understand the problem.</b>	Identify and name all relevant quantities. Make a sketch and label it.

What is the unknown?

What is to be found?

What is to be maximized or minimized?

Which: max, or min?

What are the data?

I.e., what is given?

Which quantities are constant?

Which quantities are variable?

Which can you control?

What is the condition?

I.e., what are the constraints?

What relationship(s) constrain the variables?

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**Devise a plan.**

The plan is outlined below.

**Carry out the plan.**

Write the quantity to be optimized as a function of just one variable.  
Identify the domain interval's endpoints.

Find the critical points.

Test for max/min.  
Determine the answer to the problem.

**Look back.**

Check the result.

Can you derive the result differently?

Can you use it for some other problem?

Review and check your solution.

Is it reasonable?

Have you tested for max/min?

Can you see a better way to do it?

Can you learn something from your solution?

**YES!**

You can determine the shape i.e., ratio of height to diameter, for any constant volume! Do so.