IM 9–12 MATH v.1

Unit 2

Polynomials and Rational Functions

ALGEBRA 2

Lesson 16

Minimizing Surface Area

Illustrative Mathematics®

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Learning Goal

Let's investigate surface areas of different cylinders.

Algebra 2

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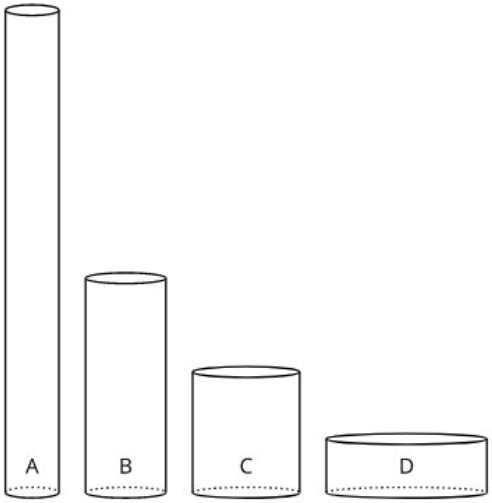
The Least Material

Warm-up

Here are four cylinders that have the same volume.



1. Which cylinder needs the least material to build?
2. What information would be useful to know to determine which cylinder takes the least material to build?

Figuring Out Cylinder Dimensions

There are many cylinders with volume 452 cm^3. Let r represent the radius and h represent the height of these cylinders in centimeters.

1. Complete the table.
2. Use graphing technology to plot the pairs (r, h) from the table on the coordinate plane.
3. What do you notice about the graph?

volume (cm^3)	radius (cm)	height (cm)
452	1	
452	2	
452	3	
452	4	
452	5	
452	6	
452	7	
452	8	
452	9	
452	10	
452	r	

Calculating Surface Area

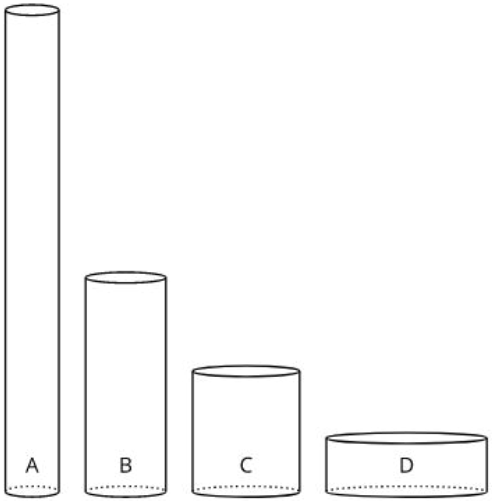
There are many cylinders with volume 452 cm3. Let represent the radius of these cylinders, represent the height, and represent the surface area.

1. Use the table to explore how the value of affects the surface area of the cylinder.
2. Use graphing technology to plot the pairs on the coordinate plane.
3. What do you notice about the graph?
4. Write an equation for as a function of when the volume of the cylinder is 452 cm3.

radius (cm)	height (cm)	surface area (cm^2)

Minimizing Surface Area

Lesson Synthesis



- Cylinder A: $r = 2$, $h = 36$
- Cylinder B: $r = 3$, $h = 16$
- Cylinder C: $r = 4$, $h = 9$
- Cylinder D: $r = 6$, $h = 4$

I can write a rational function to model different properties of cylinders.

Learning Targets

Algebra 2

Minimum Materials

Cool-down

A can manufacturing company is designing a can of cat food to hold 5.5 oz, or about 163 cm3. They have written out that the equation for the surface area for a can with this volume is $S = 2\pi r^2 + \frac{163}{r}$. Explain why the equation is wrong and how to fix it.

Here are some formulas you may find useful for the volume V and surface area S of a cylinder with radius and height .

- $V = \pi r^2 h$
- $S = 2\pi r^2 + 2\pi rh$

rational function

A rational function is a function defined by a fraction with polynomials in the numerator and denominator. Rational functions include polynomials because a polynomial can be written as a fraction with denominator 1.