Bestsize Cans

T2

The Fresha Drink Company is marketing a new soft drink.

The drink will be sold in a can that holds 200 cm^3.

In order to keep costs low, the company wants to use the smallest amount of aluminum.

Find the radius and height of a cylindrical can which holds 200 cm3 and uses the smallest amount of aluminum.

Explain your reasons and show all your calculations

$V = \pi r^2 h \quad 200 = \pi r^2 h \quad h = \frac{200}{\pi r^2}$

$S = 2\pi r^2 + 2\pi r h$

$S = 2\pi r^2 + 2\pi r\left(\frac{200}{\pi r^2}\right)$

$S = 2\pi r^2 + \frac{400\pi r}{\pi r^2}$

$S = 2\pi r^2 + \frac{400}{r}$

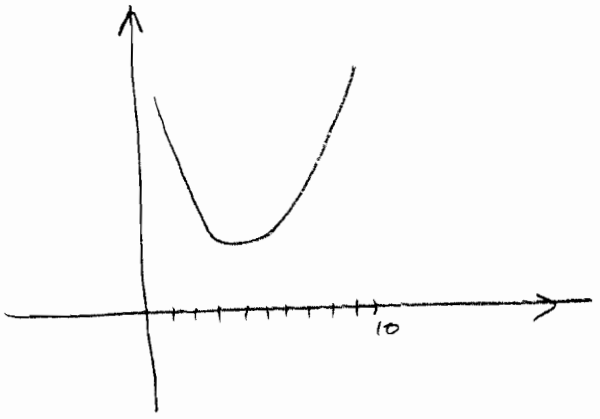
$r \approx 3\,cm \quad h = \frac{200}{\pi 3^2} = \frac{200}{28} = 7 \quad h \approx 7\,cm$

39,25

157

49

Bestsize Cans (continued)



S	406	225	190	200	237
r	1	2	3	4	5

Bestsize Cans

T3

Surface Area $= 2\pi r^2 + 2\pi r h$

Volume $= \pi r^2 h = 200$

$h = \frac{200}{\pi r^2}$

The Fresha Drink Company is marketing a new soft drink.

The drink will be sold in a can that holds 200 cm^3.

In order to keep costs low, the company wants to use the smallest amount of aluminum.

Find the radius and height of a cylindrical can which holds 200 cm3 and uses the smallest amount of aluminum.

Explain your reasons and show all your calculations

Calculations

$S.A = 2\pi r^2 + 2\pi r h = 2\pi r^2 + 2\pi r \times \frac{200}{\pi r^2} = 2\pi r^2 + \frac{400}{r}$

$r = 2 \quad SA = 8\pi + \frac{400}{2} = 225.13 \quad h = \frac{200}{\pi r^2} = 15.91$

$r = 2.5 \quad SA = 2\pi 2.5^2 + \frac{400}{2.5} = 199.27$

$r = 3 \quad SA = 18\pi + \frac{400}{3} = 189.88 \quad h = \frac{200}{\pi r^2} = 7.07$

$r = 3.5 \quad SA = 24.5\pi + \frac{400}{3.5} = 191.25$

Smallest S.A is for $r = 3$ and $h = 7.07$

Bestsize Cans

T4

Surface Area =

$2\pi r^2 + 2\pi rh$

The Fresha Drink Company is marketing a new soft drink.

The drink will be sold in a can that holds 200 cm^3.

In order to keep costs low, the company wants to use the smallest amount of aluminum.

Find the radius and height of a cylindrical can which holds 200 cm3 and uses the smallest amount of aluminum.

Explain your reasons and show all your calculations

Calculations:

Volume = 200 cm^3 = $\pi r^2 h$ Surface Area = $2\pi r^2 + 2\pi rh$

$\frac{200}{\pi} = r^2h \Rightarrow \frac{49773}{7819} = r^2h \approx 63.661977124$

r=2, h=16 $2\times2=4$ $4\times16=64$ $2\pi(2)^2 + 2\pi(32) \approx 25.1 + 201.1 \approx 226.2$

r=1, h=64 $1\times1=1$ $1\times64=64$ $2\pi(1)^2 + 2\pi(64) \approx 6.3 + 402.1 \approx 408.4$

r=3, h=$7\frac{1}{9}$ $3\times3=9$ $9\times7\frac{1}{9}=64$ $2\pi(3)^2 + 2\pi\left(\frac{64}{3}\right) \approx 56.5 + 134.0 \approx 190.5$

So, radius larger → surface area smaller! Now, try find largest radius (smallest surface area)

r=8, h=1 $8\times8=64$ $64\times1=64$ Wait... What!? $2\pi(8)^2 + 2\pi(8) \approx 402.1 + 50.2 \approx 452.3$

r=5, h=2.56 $5\times5=25$ $25\times2.56=64$ $2\pi(5)^2 + 2\pi(12.8) \approx 157.1 + 80.4 \approx 237.5$

r=4, h=4 $4\times4=16$ $16\times4=64$ $2\pi(4)^2 + 2\pi(16) \approx 100.5 + 100.5 \approx$ CCR 2

r=6, h=$\frac{16}{9}$ $6\times6=36$ $36\times\frac{16}{9}=64$ $2\pi(6)^2 + 2\pi\left(\frac{32}{3}\right) \approx 226 + 67 \approx 293$

T4

Bestsize Cans (continued)

Explanation

I kind of did a "guess and check" problem solving method. At first, I thought that the larger the radius, the smaller the surface area. The goal of this task is to find the smallest surface area for a can that can hold 200 cm^3 in volume. After many "guess and check" trials, I came to a conclusion that a radius of 3 and a height of $7\frac{1}{9}$ in a can, can have a volume of about 201. That means it can hold 200 cm^3 of liquid. And, it uses the smallest amount of aluminum possible, which is about 190.5 cm^2.

Bestsize Cans

T5

2 2 2 5 5 2

2 2
5 5

10 20

10 10 2
5 5 8

2×2×2×5×5×5

1000 10×10×10

4×25×10 100

100 250 600

100 250 780
40+40

The Fresha Drink Company is marketing a new soft drink.

The drink will be sold in a can that holds 200 cm^3.

In order to keep costs low, the company wants to use the smallest amount of aluminum.

Find the radius and height of a cylindrical can which holds 200 cm3 and uses the smallest amount of aluminum.

Explain your reasons and show all your calculations

If $r=2$ $200=\pi r^2 h \Rightarrow h=\frac{200}{\pi r^2}$

$SA=2\pi(2)^2+\frac{400}{2}=8\pi+200\approx225.13274$ $SA=2\pi r^2+2\pi rh$

If $r=3$ $SA=2\pi r^2+2\pi r(\frac{200}{\pi r^2})$

$SA=2\pi(3)^2+\frac{400}{3}=18\pi+\frac{400}{3}\approx189.882$ $SA=2\pi r^2+\frac{400}{r}$

If $r=4$

$SA=2\pi(4)^2+\frac{400}{4}=32\pi+100\approx200.530$

If $r=3.1$ $SA=2\pi(3.1)^2+\frac{400}{3.1}\approx189.4114$

Bestsize Cans (continued)

If $r = 3.2$ $SA = 2\pi(3.2)^2 + 400/3.2 = 189.34$

If $r = 3.3$ $SA = 2\pi(3.3)^2 + 400/3.3 = 189.636$.

$h = \frac{200}{\pi(3.2)^2} \approx 6.217$

Radius = 3.2

Height = 6.217