Bestsize Cans

T1

$(\pi r^2)h = 200cm^3$

$2\pi r^2 + 2\pi r \times h$ = area of aluminium

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. radius = 3 height = 7.07

Explain your reasons and show all your calculations

The volume of the drink's formula is $(\pi r^2)h = 200cm^3$. The area of aluminium is $2\pi r^2 + 2\pi r \times h$. The heights formula is $\frac{200}{\pi r^2}$ By using the formula of $2\pi r^2 + \frac{400}{r}$ I tried different varibles for r or the radius. Then found when the areas were at the smallest amount

Bestsize Cans (continued)

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

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

x = area of aluminum can

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

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

$h = \frac{200}{\pi 9}$

$= 7.07$

r	x
1	6.28 + 400 = 406.28
2	25.12 + 200 = 225.12
(3)	56.52 + 133 = 189.85
4	100.48 + 100 = 200.48
5	157 + 80 = 237
2.5	39.27 + 160 = 199.27
3.5	76.97 + 114 = 191.255

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T2

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Explain your reasons and show all your calculations

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

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

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

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

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

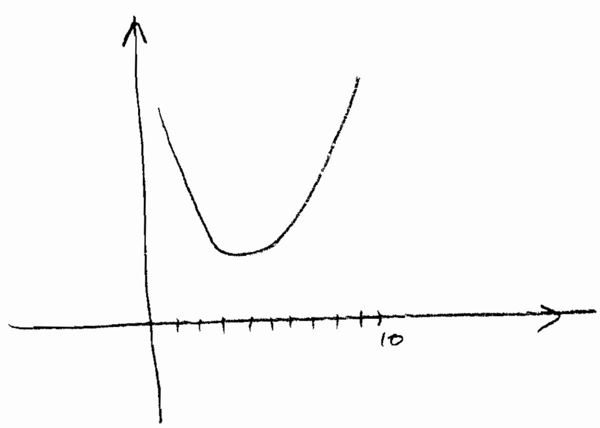
$r \approx 3 cm \quad h = \frac{200}{\pi 3^2} = \frac{200}{28} = 7 \quad h \approx 7 cm$

39,25

157

49

Bestsize Cans (continued)



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

Bestsize Cans

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

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

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

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Calculations

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

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

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

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

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

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

Bestsize Cans

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

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Explain your reasons and show all your calculations

Calculations:

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

$\frac{200}{\pi} = r^2 h \Rightarrow \frac{49773}{7819} = r^2 h \approx 63.66197724$

r=2, h=16   2x2=4   4x16=64 $2\pi(2)^2 + 2\pi(32) \approx 25.1 + 201.1 \approx 226.2$

r=1, h=64   1x1=1   1x64=64 $2\pi(1)^2 + 2\pi(64) \approx 6.3 + 402.1 \approx 408.4$

r=3, h=7 1/9   3x3=9   9x7 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   8x8=64   64x1=64 $2\pi(8)^2 + 2\pi(8) \approx 402.1 + 50.2 \approx 452.3$

Wait... What!?

r=5, h=2.56   5x5=25   25x2.56=64 $2\pi(5)^2 + 2\pi(12.8) \approx 157.1 + 80.4 \approx 237.5$

r=4, h=4   4x4=16   16x4=64 $2\pi(4)^2 + 2\pi(16) \approx 100.5 + 100.5 \approx 201$

r=6, h=16/9   6x6=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 cm³ 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

$2\times2\times2\times5\times5\times5$

1000 $10\times10\times10$

$4\times25\times10$ 100

100 250 600

100 250 780

40+40

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Explain your reasons and show all your calculations

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

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

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

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

If $r = 2$

$SA = 2\pi(2)^2 + \frac{400}{2} = 8\pi + 200 \approx 225.13274$

If $r = 3$

$SA = 2\pi(3)^2 + \frac{400}{3} = 18\pi + \frac{400}{3} \approx 189.882$

If $r = 4$

$SA = 2\pi(4)^2 + \frac{400}{4} = 32\pi + 100 \approx 200.530$

If $r = 3.1$ $SA = 2\pi(3.1)^2 + \frac{400}{3.1} \approx 189.4114$

T5

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