9.5/9.6 Maximize the Volume of a Cylinder and Minimize the Surface Area of a Cylinder

- The maximum volume for a given surface area of a cylinder occurs when its height equals its diameter. That is, *h = d or h = 2r*.

- The radius of the cylinder with maximum volume given surface area is found by using $SA = 6\pi r^2$. Once we find radius, we know height is twice that value (h = 2r)

SA of the optimal cylinder only

Example 1.

$SA = 6\pi r^2$

a) Determine the dimensions of the cylinder with maximum volume that can be made with 600 cm^2 of aluminum.

$h = 2r$

I want r and h

I know SA = 600 cm^2

$SA = 6\pi r^2$

$600 = 6\pi r^2$

$\frac{600}{6\pi} = r^2$

$31.8 = r^2$

$5.6 = r$

$r = 5.6$ cm

$h = 11.2$ cm

b) What is the volume of this cylinder?

$V = \pi r^2 h$

I need r and h

$V = \pi r^2 h$

$= \pi (5.6)^2 (11.2)$

$= 1103$

- The minimum surface area for a given volume of a cylinder occurs when its height equals its diameter. That is, *h = d or h = 2r*.
- The radius of the cylinder of minimum surface area for a given volume can be found by solving the formula $V=2\pi r^3$, and the height will be twice that value, or 2r.

Example 2. Determine the least amount of aluminum required to construct a cylindrical can with a 1-L capacity.

$V=2\pi r^3$ for optimal cylinder (ie when $h=2r$)

1L in cm^3 is $1000\ cm^3$

$$V=2\pi r^3$$
$$1000=2\pi r^3$$
$$\frac{1000}{2\pi}=r^3$$
$$159.2=r^3$$
$$\sqrt[3]{159.2}=r$$
$$5.4=r$$

radius is 5.4cm
height is 10.8cm

Practice:

508: # 1, 2, 3, 4

513 # 1, 2, 5, 6