

SUPER-SIZE IT!

Name Key

1. If 568 in² of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

$V = lwh$
 square base:
 $l = w$

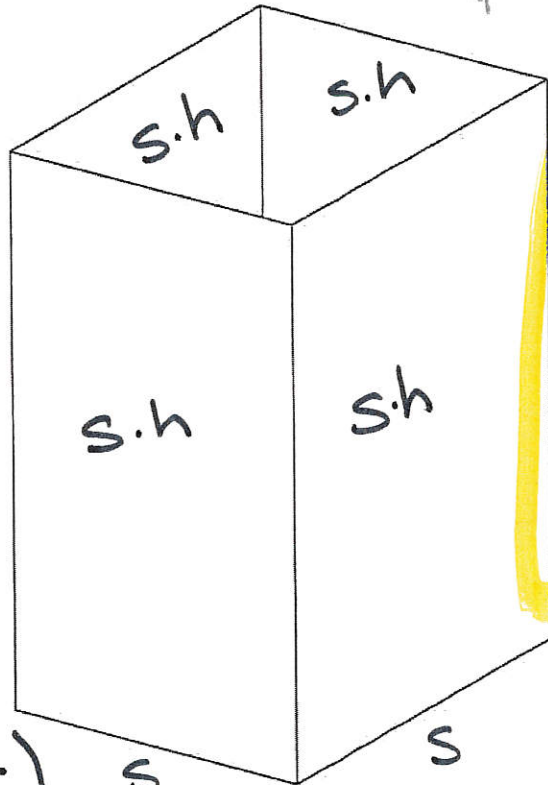
max
 $x = 13.76$
 $V = 1302.6 \text{ in}^3$

S.A. = 568

$$568 = s^2 + 4sh$$

$$568 - s^2 = 4sh$$

$$\frac{568 - s^2}{4s} = h$$



So

$$s = 13.76 \text{ in}$$

$$h = \frac{568 - 13.76^2}{4(13.76)}$$

$$h = 6.88 \text{ in}$$

$$V = 1302.6 \text{ in}^3$$

so $V = s^2 h$

$$V = s^2 \left(\frac{568 - s^2}{4s} \right) = s \frac{(568 - s^2)}{4}$$

2. Find the dimensions of the box so as to minimize the amount of material, if the box has a square base with an open top and is to hold 124 ft³

$V = lwh = 124 \text{ ft}^3$

$l = w$ so $s^2 h = 124 \text{ ft}^3$

$$h = \frac{124}{s^2}$$

min
 $s = 6.28 \text{ ft}$
 $SA = 118.42 \text{ ft}^2$
 $h = 124 / 6.28^2 = 3.144$
 Calc ~~max~~ min

Material

$$S.A = 4sh + s^2 = 4s \left(\frac{124}{s^2} \right) + s^2 = \frac{496}{s} + s^2$$

3. Find the dimensions for the maximum volume cylindrical can that "can" be made from 680 cm^2 of aluminum.

$$V = \pi r^2 h$$

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

$$680 = 2\pi r^2 + 2\pi r h$$

$$\frac{680 - 2\pi r^2}{2\pi r} = h$$

$$h = \frac{340}{\pi r} = r$$

$$V = \pi r^2 h$$

$$V = \pi r^2 \left(\frac{680 - 2\pi r^2}{2\pi r} \right)$$

$$V = \frac{r(680 - 2\pi r^2)}{2}$$

MAXIMIZE

$$V = 340r - \pi r^3$$

OR

$$V = \pi r^2 \left(\frac{340}{\pi r} - r \right) = 340r - \pi r^3$$

$$\text{MAX } r = 6 \text{ cm}$$

$$V = 1361.42 \text{ cm}^3$$

So h of max would be

$$h = \frac{340}{\pi r} - r$$

$$h = \frac{340}{6\pi} - 6 = 12 \text{ cm}$$

4. Find the dimensions for the minimum surface area cylindrical can that "can" be made to hold 346 m^3 of gasoline.

$$V = 346$$

$$V = \pi r^2 h = 346$$

$$h = \frac{346}{\pi r^2}$$

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

$$S.A. = 2\pi r^2 + 2\pi r \cdot \frac{346}{\pi r^2}$$

$$S.A. = 2\pi r^2 + \frac{692}{r}$$

Calc ~~min~~

$$\text{MIN} : r = 3.8 \text{ cm}$$

$$S.A. = 272.8 \text{ cm}^2$$

$$h = \frac{346}{\pi (3.8)^2} = 7.63 \text{ cm}$$

