SUPER-SIZE IT!

Name: Key

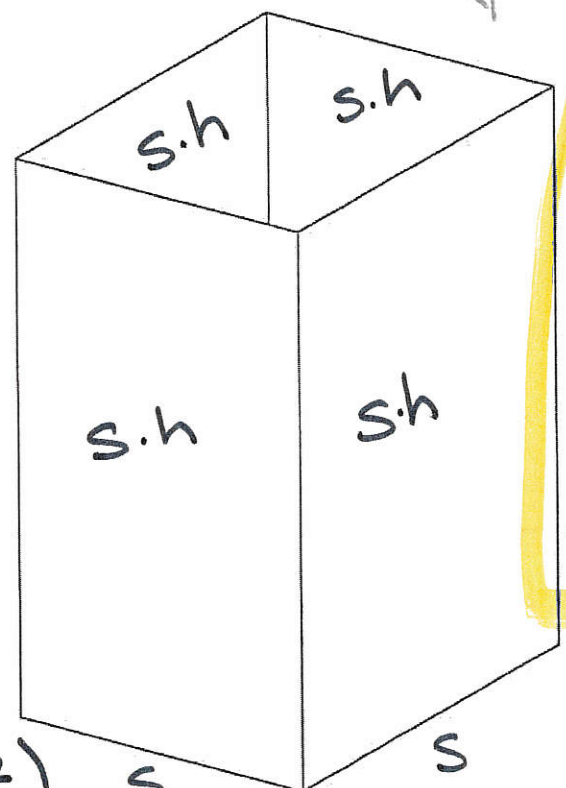
1. If 568 in^2 of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

$V = lwh$

square base:

$l = w$

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



$S.A. = 568$

$568 = s^2 + 4sh$

$568 - s^2 = 4sh$

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

so

$s = 13.76 \text{ in}$

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

$h = 6.88 \text{ in}$

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

so $V = s^2 h$

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

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 ft^3

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

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

$\boxed{h = \dfrac{124}{s^2}}$

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

calc ~~max~~ min.

material

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

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

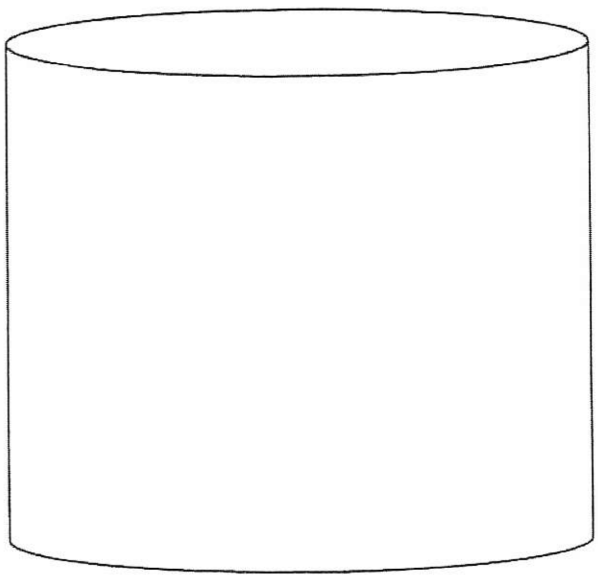
$V = \pi r^2 h$

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

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

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

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



$V = \pi r^2 h$

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

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

MAXIMIZE

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

OR

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

$= 340r - \pi r^3$ ✓

So h of max would be

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

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

MAX $r = 6$ cm

$V = 1361.42$ cm^3

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

$V = 346$

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

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

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

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

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

Calc

MIN: $r = 3.8$ cm

$S.A = 272.8$ cm^2

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