2.6 Optimizing Volume and Surface Area

From yesterday's activities we determine that the maximum volume and minimum surface area occur when you have a cube shape or a cylinder whose radius is half the height.

Square	Cube	Cylinder
$A = s^2$	$V = s^3$	$V = 2\pi r^3$ *
$P = 4s$	$S.A = 6s^2$	$S.A. = 6\pi r^2$

$V = \pi r^2 h$

$= \pi r^2 (2r)$

$V = 2\pi r^3$

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

$= 2\pi r^2 + 2\pi r(2r)$

$= 2\pi r^2 + 4\pi r^2$

$= 6\pi r^2$

Example 1:

a) Rosa constructs a rectangular prism using exactly 384 square inches of cardboard. It has the greatest volume possible. What are the ✓ dimensions of the prism? What is its volume?

Start with what you are given (knowing that you are aiming to have a cube):

$S.A. = 6s^2$

$384 = 6s^2$

$\frac{384}{6} = s^2$

$64 = s^2$

$\sqrt{64} = s$

$8 = s$

$\therefore$ The dimensions are 8" x 8" x 8"

$V = s^3$

$= 8^3$

$= 512$ sq. inches.

Oct 20-4:52 PM

b) Liam constructs a rectangular prism with a volume of exactly 1331 square metres. It has the least surface area possible. What are the dimensions of the prism?

Again, remember you are working toward a cube: CUBE

$V = s^3$

$1331 = s^3$

$\sqrt[3]{1331} = s$

$11 = s$

∴ The dimensions are 11m x 11m x 11m

Example 2: a) Naveed is designing a can with volume 350 mL. What is the minimum surface area of the can? Determine the dimensions of a can with the minimum surface area.

*Note $1\ mL = 1\ cm^3$

$V = 2\pi r^3$

$350 = 2\pi r^3$

$\frac{350}{(2\pi)} = r^3$

$55.7 = r^3$

$\sqrt[3]{55.7} = r$

$3.8 \doteq r$

∴ The dimensions are a can with radius 3.8 cm and a height $2 \times 3.8 = 7.6$ cm

b) What is the maximum volume for a cylinder which has a surface area of $13400cm^2$

$S.A. = 6\pi r^2$

$13400 = 6\pi r^2$

$\frac{13400}{6\pi} = r^2$

$710.89 = r^2$

$\sqrt{710.89} = r$

$26.7 = r$

$V = 2\pi r^3$

$= 2\pi(26.7)^3$

$= 119\,595\,cm^3$

Success Criteria for Optimization Problems:

① MAX/MIN
→ Special Formulas

Oct 21-8:57 AM

Homework:

p. 110 #1,2,6,10,13

Mar 31-1:21 PM

Formative Assessment:
p. 112 #15
Hand in before you leave--
we will look at answers
tomorrow

If you haven't completed p. 86 do so ASAP -- Hand in to MSIP teacher this afternoon if you can.

Oct 21-8:56 AM