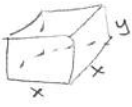


**Optimization (continued again)**

Determine the dimensions of a rectangular solid (with a square base) of maximum volume if its surface area is 150 square inches.

①   $SA = 150 \text{ in}^2$        $x = ?$   
 $y = ?$   
 $V = ?$

②  $SA = 2x^2 + 4xy$   
 $150 = 2x^2 + 4xy$   
 $150 - 2x^2 = 4xy$   
 $\frac{150 - 2x^2}{4x} = y$

$V = x^2 y$   
 $V = x^2 \left( \frac{150 - 2x^2}{4x} \right)$   
 $V(x) = \frac{150x^2 - 2x^4}{4x}$

③  $V(x) = \frac{75}{2}x - \frac{1}{2}x^3$

④  $\text{set } y = 0 \dots$  ☹️  
 $\frac{150 - 2x^2}{4x} = 0$   
 $150 - 2x^2 = 0$   
 $2x^2 = 150$   
 $x^2 = 75$   
 $x = \sqrt{75}$

$0 < x < \sqrt{75}$

⑤  $V'(x) = \frac{75}{2} - \frac{3}{2}x^2$   
 $0 = \frac{75}{2} - \frac{3}{2}x^2$   
 $\frac{3}{2}x^2 = \frac{75}{2}$   
 $x^2 = 25$   
 $x = 5$

$y = \frac{150 - 2(5)^2}{4(5)}$   
 $= \frac{150 - 50}{20}$   
 $= 5$

⑥ The dimensions are:  $5 \text{ in} \times 5 \text{ in} \times 5 \text{ in}$