2.7-2.8 Applications HW **Calculator OK** Name Solutions

1. A number plus twice a second number is 108. Find the two numbers that give a maximum product.

$x + 2y = 108$

$y = \frac{108 - x}{2}$

$P = xy = x\left(\frac{108-x}{2}\right)$

$P = 54x - \frac{1}{2}x^2$

$x = 54$ IS A MAXIMUM

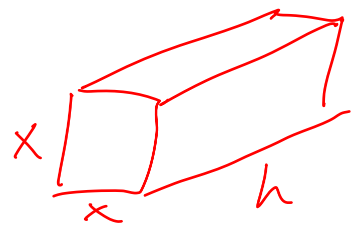
$y = \frac{108-54}{2} = 27$

$x = 54,\ y = 27$

2. A rectangular solid with a square base has a surface area of 150 square inches.

a) Find the maximum volume of the solid and its dimensions.

$SA = 2x^2 + 4xh = 150$



$h = \frac{150 - 2x^2}{4x}$

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

$x = 5$ MAXIMIZES V

@ $x = 5$. $h = 5$

$V_{MAX} = x^2 \cdot h = 125 \text{ IN}^3$

b) What dimensions can this rectangular solid have if it must have a volume over 100 cubic inches?

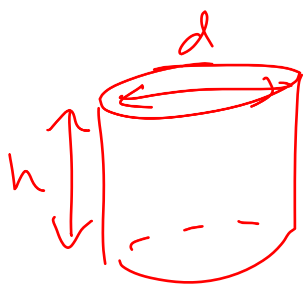
$100 < x^2 \cdot \left(\frac{150 - 2x^2}{4x}\right) < 125$ solve graphically

Base: $3.042 \text{ IN} < x < 6.729 \text{ IN}$

Height: $2.208 \text{ IN} > \frac{150 - 2x^2}{4x} > 0.806 \text{ IN}$

3. The diameter plus the height of a cylindrical package is equal to 108 inches.

a) Find the dimensions of the package that gives you a maximum volume.



$d + h = 108$

$h = 108 - d$

$V = \pi \left(\frac{d}{2}\right)^2 h$

$V = \pi \frac{d^2}{4}(108 - d)$

$d = 72$ MAXIMIZES V

$h = 108 - d = 36$ in

$V_{MAX} = 146{,}574.15 \text{ IN}^3$

b) Find the dimensions of the package if the volume must be over 100,000 cubic inches.

$100{,}000 < \pi \frac{d^2}{4}(108 - d) < V_{MAX}$ solve graphically.

diameter: $44.931 \text{ IN} < d < 93.407 \text{ IN}$

Height: $63.069 \text{ IN} < 108 - d < 14.593 \text{ IN}$