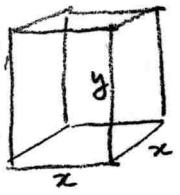
11. If 1200 cm^2 of material is available to make a box with a *square base* and an *open top*, find the largest possible volume of the box. (Prove that the volume you found is the *largest*.)

11 pts



$V = x \cdot x \cdot y$ $\quad x^2 + 4xy = 1200$

$= x\left(\frac{1200 - x^2}{4}\right)$ $\quad xy = \frac{1200 - x^2}{4}$

$= 300x - \frac{1}{4}x^3 \Rightarrow V' = 300 - \frac{3}{4}x^2 = 0$

if $x = \sqrt{\frac{300 \times 4}{3}} = 20$ cm $\quad V''(20) = -\frac{3}{2}(20) < 0$

$\Rightarrow$ volume is max @ $x = 20$ cm.

$y = \frac{1200 - 400}{4(20)} = 10$

max vol $= (20)^2 \cdot 10 = 4000$ cm^3.

12. **Extra credit**: Use Part 2 of the Fundamental Theorem of Calculus to evaluate the integral $\int_{-2}^{2} \frac{4}{u^3}\,du$, or explain why it does not exist.

5 pts

It does not exist because $\frac{4}{u^3} = f(u)$ has an infinite discontinuity at $u = 0$, which is between -2 & 2.