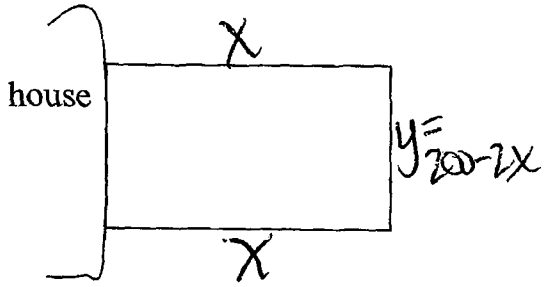
Name: Key Date:

Pre-Calc Review Sheet on Optimization problems Mrs. Dounias

For each word problem:

1: Make a diagram, labeling all dimensions involved, in terms of x.
2: Determine what is "fixed" and what is being maximized or minimized.
3. Write an appropriate function (either for Volume or Area or Surface Area)
4. Show a sketch of your function, either by hand or with the help of calculator
5. Be sure to answer exactly the question being asked.
6. Round answers, where necessary, to ***the nearest hundredth***.

1) A rectangular garden is to be fenced in with 200 feet of fencing where you use one side of your house as one of the sides of the rectangle. What should the dimensions of the garden be to produce the largest area?




$x+x+y=200$

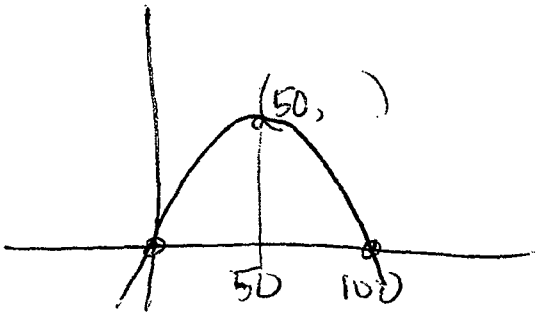
$y=200-2x$

Fixed P
Max A

$A=x(200-2x)$

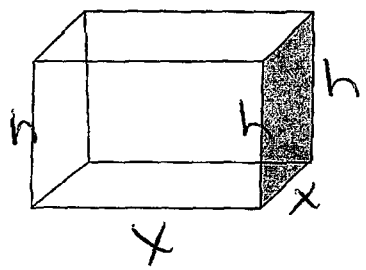
Make $x=50$

Garden Should be $50\times100$




2) An open top box with a square base is to be constructed from 120 square inches of material. What dimensions will produce a box with the largest possible volume? What is the volume of the box?

Fixed SA
MAX V

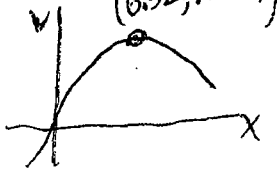



$SA=120=x^2+4xh$

Max Vol

$h=\frac{120-x^2}{4x}=\frac{120-(6.32)^2}{4(6.32)}$

$V=x\cdot x\cdot\left(\frac{120-x^2}{4x}\right)=\frac{x(120-x^2)}{4}$

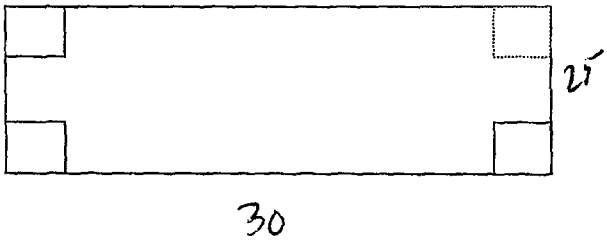


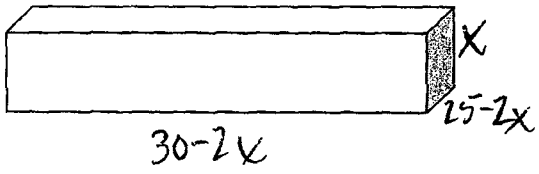

Box Should be: $6.32\times6.32\times3.17$

Max Vol = 126.49

Fixed A
Max V

3) A box with no top is to be made from a 25 x 30 inch sheet of cardboard by cutting squares of equal size from each corner and bending up the flaps. To the nearest hundredth of an inch, what size square should be cut from each corner to obtain a box with the largest possible volume? What is the volume of this box?

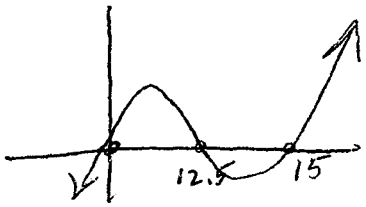



$V = x(25-2x)(30-2x)$

$x = 4.53$

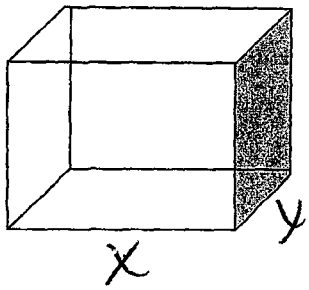
Max Vol = 1512.04




Fixed V

4) Find the dimensions of a rectangular box with a ***square base*** and ***no top*** that has a volume of 2000 cubic centimeters and the ***smallest possible surface area***.

Min SA




$V = 2000\ cm^3$

$SA =$

$h = \frac{2000}{x^2} = \frac{2000}{(15.87)^2}$

$= x^2 + 4\left(x\left(\frac{2000}{x^2}\right)\right)$

$= x^2 + \frac{8000}{x}$

When $x = 15.87$ $SA = 755.95$

Max Box a $15.87 \times 15.87 \times 7.94$