lve the problem analytically.

1) Of all numbers whose sum is 140, find the two that have the maximum product. That is, maximize Q = xy, where x + y = 140. 1) ______________

2) Of all numbers whose difference is 18, find the two that have the minimum product. 2) ______________

1)

$Q = xy$

$x + y = 140$

$-y \quad -y$

$x = 140 - y$

$Q = (140-y)y$

$Q = 140y - y^2$

$Q' = 140 - 2y = 0$

$y = 70$

$x = 70$

$x - y = 18$

$+y \quad +y$

$x = 18 + y$

$xy = P$

$(18+y)y = P$

$18y + y^2 = P$

$18 + 2y = 0$

$y = -9$

$x = 9$

lve the problem.

3) Find the dimensions that produce the maximum floor area for a one–story house that is rectangular in shape and has a perimeter of 121 ft. Round to the nearest hundredth, if necessary.

4) From a thin piece of cardboard 20 in. by 20 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? Round to the nearest tenth, if necessary.

3 $2x+2y=121 \rightarrow x=\frac{121-2y}{2}$

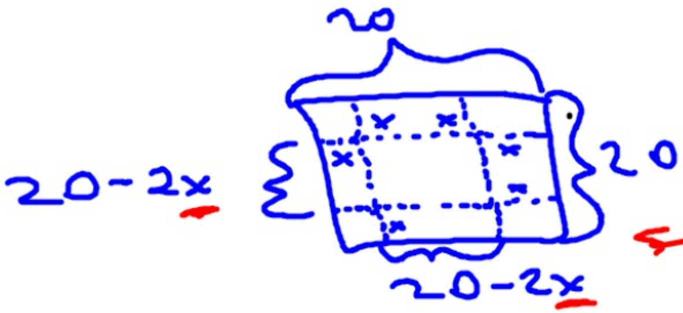
$xy = \text{Max}\#$

$\left(\frac{121-2y}{2}\right)y=\#$

$\frac{121}{2}y-y^2=\#$

$\rightarrow \frac{121}{2}-2y=0$

$\frac{121}{4}=y$ and x



4) From a thin piece of cardboard 20 in. by 20 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? Round to the nearest tenth, if necessary. 4) ____________

$V = wlh \leftarrow$ $w = 20-2x$, $l = 20-2x$, $h = x$

$\# = (20-2x)(20-2x)x$

$\# = (400-80x+4x^2)x$

$\# = 400x - 80x^2 + 4x^3$

$0 = 400 - 160x + 12x^2$

$0 = 100 - 40x + 3x^2$

$0 = 3x^2 - 40x + 100$

$a = 3$

$b = 40$

$c = 100$

$x = \dfrac{40 \pm \sqrt{1600-1200}}{6} = \dfrac{40 \pm 20}{6} = \dfrac{60}{6}, \dfrac{20}{6}$

$x = \dfrac{40 \pm \sqrt{400}}{6}$

10 or $3\frac{1}{3}$

can't use it!

$$\left(\text{price of product}\right) \times \left(\text{\# of items sold}\right) = \text{Revenue}$$

5) If the price charged for a bolt is p cents, then x thousand bolts will be sold in a certain hardware store, where $p = 42 - \frac{x}{18}$. How many bolts must be sold to maximize revenue? 5) ____

$$R = \left(42 - \frac{x}{18}\right)(x)$$

$$R = 42x - \frac{x^2}{18}$$

$$0 = 42 - \frac{x}{9}$$

$$\frac{x}{9} = 42$$

$$x = 378$$

Revenue − cost = profit

$$R(x) - C(x) = P(x)$$

6) Find the number of units that must be produced and sold in order to yield the maximum profit, given the following equations for revenue and cost: 6) ____

$R(x) = 7x$

$C(x) = 0.001x^2 + 0.9x + 20.$

$$7x - (.001x^2 + .9x + 20) = P(x)$$

$$-.001x^2 + 6.1x - 20 = P(x)$$

$$-.002x + 6.1 = 0$$

$$\frac{-.002x}{-.002} = \frac{-6.1}{-.002}$$

$$x = 3050$$

$$\begin{array}{r} \overset{6}{7}.\overset{10}{0} \\ -\ .9 \\ \hline \end{array}$$