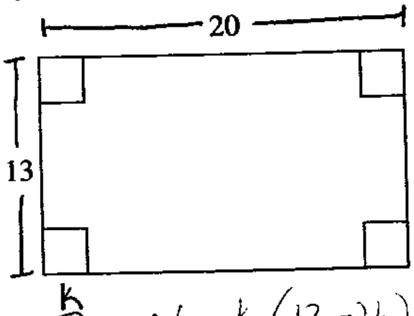
Solve:

1) Given a rectangle sheet of paper 20 in by 13 in, we want to cut off square corners of length k, so that the paper folds into an open topped box. What should k be in order to maximize the volume of the box?



$\boxed{k = 2.6 \text{ in.}}$

$V = k(13-2k)(20-2k)$

$V = 4k^3 - 66k^2 + 260k$

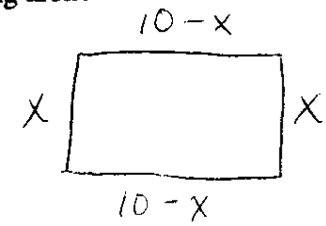
$V'(k) = 12k^2 - 132k + 260$

$3k^2 - 33k + 65 = 0$

$k = \dfrac{33 \pm \sqrt{1089 - 4 \cdot 3 \cdot 65}}{6} = \dfrac{33 \pm \sqrt{309}}{6} = 8.4,\ 2.6$

	$(-\infty, 2.6]$	$[2.6, 8.4]$	$[8.4, \infty)$
k'	$k' > 0$	$k' < 0$	$k' > 0$

2) Farmer Ivan has a fence of length 20 ft. Ivan wants to create the biggest grazing area possible. What is the maximal area of the grazing area?



$A = x(10-x) = 10x - x^2$

$A'(x) = 10 - 2x$

$10 - 2x = 0$

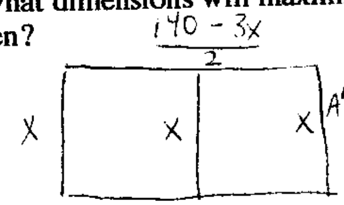
$x = 5$

	$(-\infty, 5]$	$[5, \infty)$
A'	$A' > 0$	$A' < 0$

5 ft. × 5 ft.

$= \boxed{25 \text{ ft.}^2}$

3) John wants to build a rectangular pen with 2 equal partitions. Assuming all the partitions are parallel, and that John has 140 feet of fencing to use, what dimensions will maximize the area of the pen?



	$(-\infty, \frac{70}{3}]$	$[\frac{70}{3}, \infty)$
A'	$A' > 0$	$A' < 0$

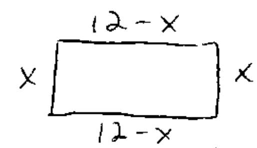
$A = x\left(\dfrac{140-3x}{2}\right) = \dfrac{140x - 3x^2}{2} = 70x - \dfrac{3}{2}x^2$

$A'(x) = 70 - 3x \quad 70 - 3x = 0 \quad x = 70/3$

$\frac{70}{3}$ ft. × $\frac{175}{3}$ ft.

or $\boxed{23\tfrac{1}{3} \text{ ft.} \times 58\tfrac{1}{3} \text{ ft.}}$

4) Farmer Erin has a fence of length 24 ft. Erin wants to create the biggest grazing area possible. What is the maximal area of the grazing area?



$A = x(12-x) = 12x - x^2$

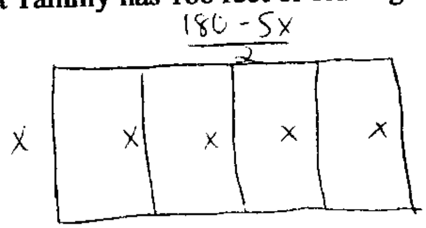
$A'(x) = 12 - 2x$

$12 - 2x = 0 \quad x = 6$

$6 \times 6 =$

$\boxed{36 \text{ ft.}^2}$

5) Tammy wants to build a rectangular pen with 4 equal partitions. Assuming all the partitions are parallel, and that Tammy has 180 feet of fencing to use, what dimensions will maximize the area of the pen?



$A = x\left(\dfrac{180-5x}{2}\right) = \dfrac{180x - 5x^2}{2} = 90x - \dfrac{5}{2}x^2$

$A'(x) = 90 - 5x$

$90 - 5x = 0$

$x = 18$

	$(-\infty, 18]$	$[18, \infty)$
A'	$A' > 0$	$A' < 0$

$\boxed{18 \text{ ft.} \times 45 \text{ ft.}}$