

Key

## Optimization – Do all work on separate paper

- *PROBLEM 1* : Find two nonnegative numbers whose sum is 9 and so that the product of one number and the square of the other number is a maximum.

◦

- *Solution*  $x=3$  and  $y=6$

◦

- *PROBLEM 2* : Build a rectangular pen with three parallel partitions using 500 feet of fencing. What dimensions will maximize the total area of the pen ?

◦

- *Solution:*  $x=50$  ft. and  $y=125$  ft

- *PROBLEM 3* : An open rectangular box with square base is to be made from  $48 \text{ ft.}^2$  of material. What dimensions will result in a box with the largest possible volume ?

◦

*Solution:*  $x=4$  ft. and  $y=2$  ft.

- *PROBLEM 4* : A container in the shape of a right circular cylinder with no top has surface area  $3\pi \text{ ft.}^2$ . What height  $h$  and base radius  $r$  will maximize the volume of the cylinder ?

◦

- *Solution*  $r=1$  ft. and  $h=1$  ft

◦

- *PROBLEM 5* : A sheet of cardboard 3 ft. by 4 ft. will be made into a box by cutting equal-sized squares from each corner and folding up the four edges. What will be the dimensions of the box with largest volume ?

*Solution:*  $x \approx 0.57$  ft.

Example 3

Tiffany and Adam are graphing functions. Tiffany is graphing  $f(x) = \frac{5x-3}{x}$

and Adam is graphing  $g(x) = 5 - \frac{3}{x} = \frac{5x-3}{x}$

- a) The teacher asks both students to first write the domain of each of the functions. What should Tiffany say? What should Adam say?

$x \neq 0$  in both.  $\therefore$  each should say  $D: (-\infty, 0) \cup (0, \infty)$

- b) Because these are both rational functions, the teacher asks both students to identify the asymptotes for each of the functions. What should each person say?

V.A.  $x = 0$

H.A.  $y = 5$

Ex. 4. The function  $C(t) = \frac{5t}{0.01t^2 + 3.3}$  describes the concentration of a drug in the blood stream over time. In this case, the medication was taken orally.  $C$  is measured in micrograms per milliliter and  $t$  is measured in minutes.

- a) Sketch a graph of the function over the first two hours after the dose is given. Label axes.

time in mins  $\left\{ \begin{array}{l} x_{\min} = 0 \\ x_{\max} = 120 \text{ mins.} \end{array} \right.$

mc/ml  $\left\{ \begin{array}{l} y_{\min} = 0 \\ y_{\max} = 40 \end{array} \right.$



- b) Determine when the maximum amount of the drug is in the body and the amount at that time.

Calc max:  $(18.17, 13.76)$

18.17 minutes after med is taken, its concentration in blood will be at its max  $\rightarrow$  13.76 mc/ml