4.4 APPLIED OPTIMIZATION.

GOAL: FIND A FUNCTION THAT MODELS A PROBLEM, USE THE TECHNIQUES OF 4.1 & 4.2 TO FIND THE "BEST" VALUE.

SUGGESTED PROCEDURE:

1. DRAW A DIAGRAM, LABEL VARIABLES
2. IDENTIFY QUANTITY TO MAXIMIZE/MINIMIZE
3. FIND A FORMULA FOR THE QUANTITY TO MINIMIZE/MAXIMIZE
4. USE CONSTRAINTS TO ELIMINATE EXTRA VARIABLES. (i.e., GET A FUNCTION OF ONE VARIABLE)
5. FIND THE DOMAIN
6. FIND THE GLOBAL MIN/MAX (DON'T FORGET TO ANSWER THE QUESTION) (FIND THE DERIVATIVE, FIND THE C.P.S, THEN EITHER
   a. IF THE INTERVAL IS CLOSED: SUBSTITUTE ENDPOINTS AND C.PS INTO FUNCTION, CHOOSE LARGEST/SMALLES

   OR
   b. IF THE INTERVAL IS OPEN: HOPE THERE IS ONLY ONE C.P., SHOW THERE IS A LOCAL MAX/MIN THERE, CONCLUDE IT IS ALSO A GLOBAL MIN/MAX

EX 1 FIND TWO NON-NEGATIVE NUMBERS WHOSE SUM IS 200 AND WHOSE PRODUCT IS MAXIMUM

CUT THIS SQUARE OUT

CUT THIS SQUARE OUT

FOLD

EX: THE CORNERS ARE CUT OUT OF AN $8\frac{1}{2}$" x 11" PIECE OF PAPER AND IT IS FOLDED INTO A BOX. WHAT SIZE SQUARES SHOULD BE REMOVED TO MAXIMIZE THE VOLUME?

FOLD

FOLD

FOLD

CUT THIS SQUARE OUT

CUT THIS SQUARE OUT

A rectangle is inscribed in the triangle with vertices $(0,0)$, $(4,0)$, $(0,8)$, one side of the rectangle lying on the x-axis and one side lying on the y-axis. What is the maximum area of the rectangle?

Find the point on the parabola $y^2 = 2x$ that is closest to the point $(1, 4)$.

A RECTANGULAR MURAL WILL HAVE A TOTAL AREA OF 24 ft^2, WHICH INCLUDES A BORDER OF 1 ft ON THE LEFT, RIGHT AND BOTTOM AND A BORDER OF 2 ft ON THE TOP. WHAT DIMENSIONS MAXIMIZE THE TOTAL PAINTABLE AREA INSIDE THE BORDERS?

A CAN IS MADE TO HOLD 1 LITER OF OIL. FIND THE DIMENSIONS THAT WILL MINIMIZE THE COST OF THE METAL TO MANUFACTURE THE CAN

A glass fish tank is to be constructed to hold 72 ft^3 of water. The top is to be open. Its width will be 5 ft but the length and depth are variable. Building the tank costs $10 per square foot for the base and $5 per square foot for the sides. What is the cost of the least expensive tank?