4.4 MODELING, OPTIMIZATION

MAXIMUMS OR MINIMUMS OCCUR AT ENDPOINTS OR WHEN $\frac{dy}{dx} = 0$

STRATEGIES FOR SOLVING MAX-MIN PROBLEMS BOTTOM OF p. 208. (SUGGESTIONS)

EXAMPLE

$X + Y = 20 \longrightarrow Y = 20 - X$ MAXIMIZE $X \cdot Y$

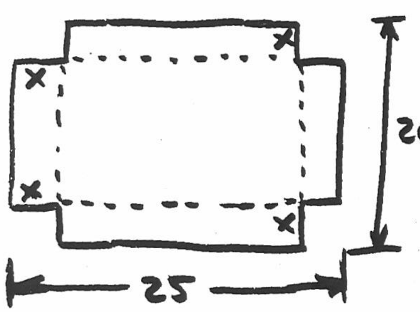
PRODUCT $= P = X \cdot Y = X(20 - X)$

$P = 20X - X^2$ $\frac{dP}{dX} = 20 - 2X$ $20 - 2X = 0$ $X = 10$

$Y = 20 - X = 20 - 10$ $Y = 10$

EXAMPLE 1 p. 206

OPEN TOP BOX CUT OUT OF 20×25 SHEET MAXIMIZE THE VOLUME.



$V = lwh$

$V = (25 - 2X)(20 - 2X)X$

$V = 4X^3 - 90X^2 + 500X$

$\frac{dV}{dX} = 12X^2 - 180X + 500$

OVER →

Solve$(12X^2-180X+500=0, X)$ TI-89 OR

$Y1=12X^2-180X+500$ QUADRATIC FORMULA **OR**

GRAPH MORE MATH ROOT $X=3.681$ $X=11.319$

DOMAIN $0<X<10$ MAXIMUM IMPOSSIBLE

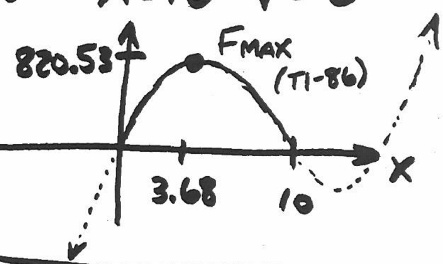
BECAUSE X IS HEIGHT & 20-2X IS WIDTH

$V=(25-2*3.681)(20-2*3.681)3.681=\underline{820.53}$

AT END POINTS $X=0$ $V=0$ $X=10$ $V=0$

So MAX $V=820.53$

$Y=4X^3-90X^2+500X$ →



EXAMPLE p.217 #32a

$S=kwd^2$ $w^2+d^2=12^2 \rightarrow d^2=144-w^2$

$S=kw(144-w^2) \rightarrow S=144kw-kw^3$

$\frac{dS}{dw}=144k-3kw^2$ $144k-3kw^2=0$

$3k(48-w^2)=0$ $48-w^2=0$ $w=\sqrt{48}$

$d^2=144-w^2=144-(\sqrt{48})^2=96$ $d=\sqrt{96}$

$\boxed{\text{DIMENSIONS } \sqrt{48}\times\sqrt{96}}$ STRONGEST BEAM

HOMEWORK p.214-217 → 1-33 **ODD**

1 a only 23 ab only
33 a only

$\boxed{\text{AB OMIT } 23, 25, 27}$