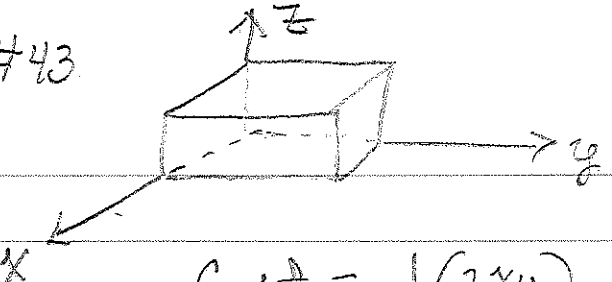
#43



Vol $= 16 = xyz$

$\text{Cost} = .1(2xy) + .05(2xz) + .05(2yz)$, minimize!

For the calculus simplify the above! Divide by .1

$C = \frac{\text{Cost}}{.1} = 2xy + xz + yz$, minimize this!

Subst. $z = \frac{16}{xy}$ into above eq.

$C = 2xy + \frac{16}{y} + \frac{16}{x}$, obtain critical pt.(s)

$C_x = 2y - \frac{16}{x^2}$, $C_y = 2x - \frac{16}{y^2}$, set to 0 and solve

$y = \frac{8}{x^2}$, $x = \frac{8}{y}$, so $x = \frac{8}{\frac{8^2}{x^4}}$, or $x = \frac{1}{8}x^4$ or $8x = x^4$

Solving $x(x^3 - 8) = 0$, so $x = 0$ or $x = 2$. But x can not be 0.

If $x = 2$ then $y = 2$ and $z = 4$.

From 2nd partial derivative test

$C_{xx} = 4 = C_{yy}$, $C_{xy} = 2$ so $D = 16 - 4 > 0$

$\therefore$ local min at $(2,2)$

I say there is no boundary! ie $0 < x < 16$, $0 < y < 16$.
This local min is actually

Abs. Min! Cost $= \$2.40$ at $(2,2,4)$

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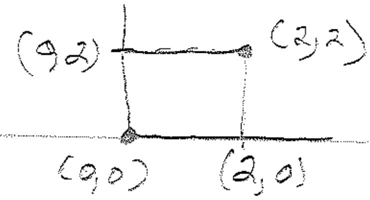
$f(x,y) = x^2 - 3y^2 - 2x + 6y$ on



1. Interior critical points

$f_x = 2x - 2 = 0 \implies x = 1$
$f_y = -6y + 6 = 0 \implies y = 1$ } (1,1) is only interior critical point

2. Boundary critical points

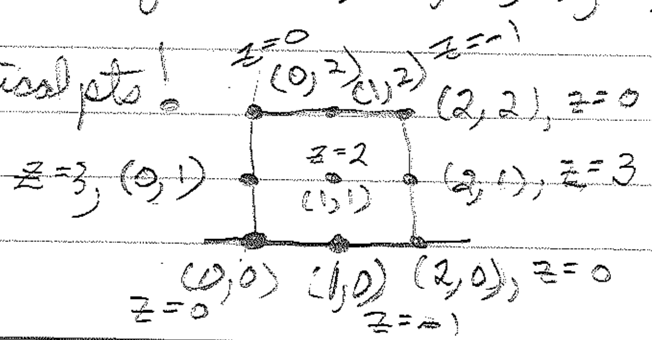
a) $x = 0, \ 0 \le y \le 2$.
functions become $f(0,y) = -3y^2 + 6y$, one var. funct.
$\frac{df}{dy} = -6y + 6 = 0 \implies y = 1$, so critical pt at $(0,1)$.
End pts also critical. Here $(0,0)$ and $(0,2)$.

b) $x = 2, \ 0 \le y \le 2$. Work similar to above!
critical pts $(2,0), (2,1), (2,2)$

c) $y = 0, \ 0 \le x \le 2$
function becomes $f(x,0) = x^2 - 2x$, one var. funct
$\frac{df}{dx} = 2x - 2 = 0 \implies x = 1$, so critical pt at $(1,0)$
End pts also critical. Here $(0,0), (2,0)$.

d) $y = 2, \ 0 \le x \le 2$ Work similar to above!
critical pts $(0,2), (1,2), (2,2)$.

3. 9 critical pts!



max value 3 at $(0,1), (2,1)$

min value -1 at $(1,2), (1,0)$