THE UNIVERSITY OF CALGARY
DEPARTMENT OF MATHEMATICS & STATISTICS
MATHEMATICS 353-02
QUIZ #1T

WINTER 2008
NAME: _____ **I.D. No.**:_____

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1. Find ∂D - boundary of D. Is D closed? Open? Bounded?
   Sketch/Describe the set.

   (a) $D = \{(x, y) \mid y < \sqrt{x}\}$

   (b) $D = \{(x, y, z) \mid 3x + 2y - z = 1\}$
   (c) $D = \{x; |x| < 1\}$. [5]

2. Find all local extrema of $f(x, y) = x^3y - 12x^2 - y^2$ in its domain. Explain. [5]

SOLUTION
for 1a)
it must $x \geq 0$ and y is (pos, zero or negative) below the half-parabola $y = \sqrt{x}$
so the set **UNBDD**
and the boundary is $\partial D = \{y = \sqrt{x}, x \geq 0\} \cup \{x = 0, y < 0\}$
first part is out,second part is in,so **neither open nor closed.**
for1b)
the set is a plane so $D = \partial D$ is **CLOSED and unbounded**.
for 1c)

$D = (-1, 1)$ $\partial D = \{-1, 1\}$ two points , **open and bounded.**
For 2)
f is defined, continous,differentiable everywhere,for critical points solve
$f_x = 3x^2y - 24x = 3x(xy - 8) = 0$ $x = 0$ OR $xy = 8$
$f_y = x^3 - 2y = 0$ $x^3 = 2y$
together if $x = 0$ then $y = 0$
if $x \neq 0$ $y = \frac{8}{x}$ and $x^3 = \frac{16}{x}$ then $x^4 = 16$ so $x = \pm 2, y = \pm 4$
we got 3 critical points $(0, 0), (2, 4), (-2, -4)$
for Second Derivative Test

$f_{xx} = 6xy - 24 \qquad f_{xy} = 3x^2 \qquad f_{yy} = -2$

Now	A	B	C	D	
$(0,0)$	-24	0	-2	*neg*	*loc.* max
$(2,4)$	24	12	-2	*pos*	*saddle*
$(-2,-4)$	24	12	-2	*pos*	*saddle*