MATH 201- Sec04-Quiz 3

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1 Exercise 1(5 points)

Find the symmetric equations of the line D of intersection between the two planes

$$x + 2y + 3z = 3, \quad 2x - y + z = 1.$$

Find the intersection of D with the xy-plane

2 Exercise 2(5 points)

Find and sketch the domain of $f(x, y) = \frac{1}{\ln(4x^2 - y + 1)}$. Find the level curves and sketch some of them.

Answer(1):

∘) $x+2y+3z=3 \Rightarrow \vec{n_1} = \langle 1, 2, 3 \rangle$

$2x - y + z = 1 \Rightarrow \vec{n_2} = \langle 2, -1, 1 \rangle$

Let $\vec{u} = \vec{n_1} \times \vec{n_2} = \begin{vmatrix} i & j & k \\ 1 & 2 & 3 \\ 2 & -1 & 1 \end{vmatrix} = \langle 5, 5, -5 \rangle$. $\vec{u}$ is parallel to the line.

It is clear that $(0,0,1)$ is a commun point.

Then, the symmetric equations are $\frac{x-0}{5} = \frac{y-0}{5} = \frac{z-1}{-5}$

$\Leftrightarrow x = y = 1 - z$

∘) xy-plane $\Rightarrow z = 0 \Rightarrow x = y = 1 - z = 1 - 0 = 1$

Conclusion. The intersection point is $(1, 1, 0)$.

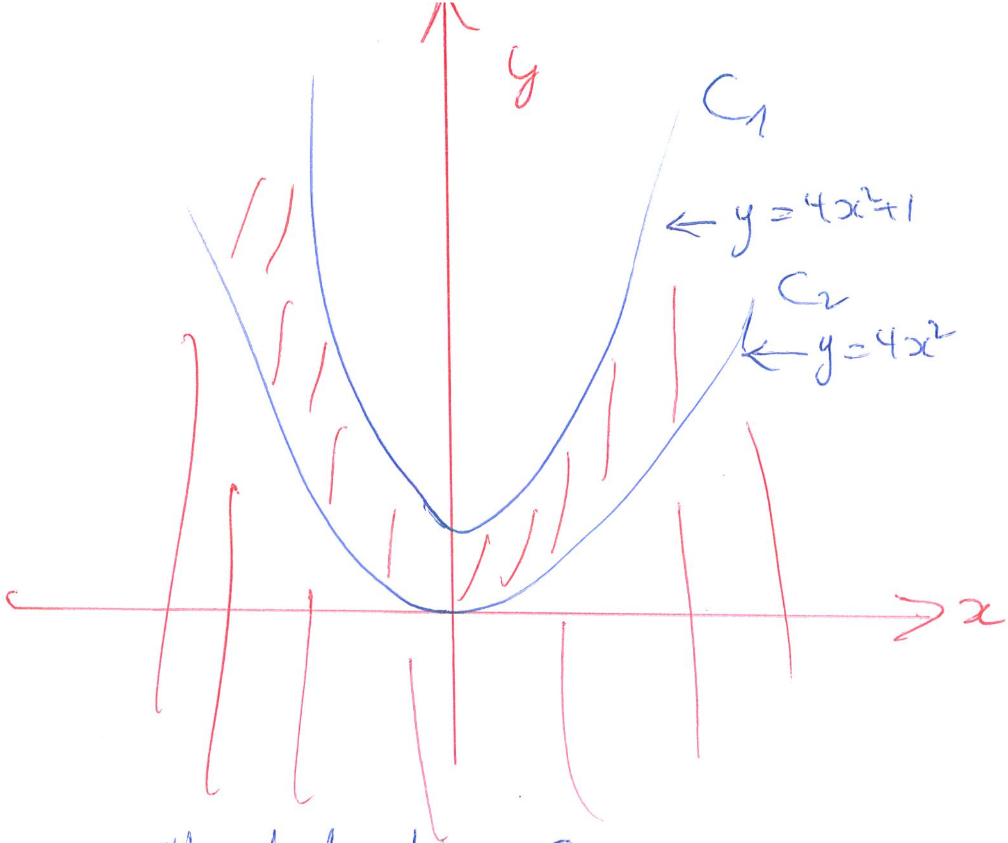
Answer2:

$\frac{1}{\ln(4x^2-y+1)}$ exists if and only if $4x^2 - y + 1 > 0$ and $\ln(4x^2-y+1) \neq 0$

$\Rightarrow y < 4x^2 + 1$ and $4x^2 - y + 1 \neq 1$

$\Rightarrow y < 4x^2 + 1$ and $y \neq 4x^2$

$C_1: y = 4x^2 + 1$ $\quad C_2: y = 4x^2$



under C_1 without touching C_2.

*) Level curves: $C_k=\{(x,y) : f(x,y)=k\}$

$=\{(x,y) : \frac{1}{\ln(4x^2-y+1)}=k\} = \{(x,y) : 4x^2-y+1=e^{\frac{1}{k}}\}$

$=\{(x,y) : y=4x^2+1-e^{1/k}\}$ parabola

symmetry axis: y-axis

$k\in\mathbb{R}\setminus\{0\}$