Name:

1. Find an equation for the tangent line of the curve $\mathbf{r}(t) = \sin(2t)\mathbf{i} + e^{-t}\mathbf{j}$ at $t = 0$.

$\vec{r}(0) = \sin(0)\hat{i} + e^{0}\hat{j} \quad \langle 0, 1 \rangle$

$\vec{r}\,'(t) = 2\cos(2t)\hat{i} - e^{-t}\hat{j}$

$\vec{r}\,'(0) = \langle 2, -1 \rangle$

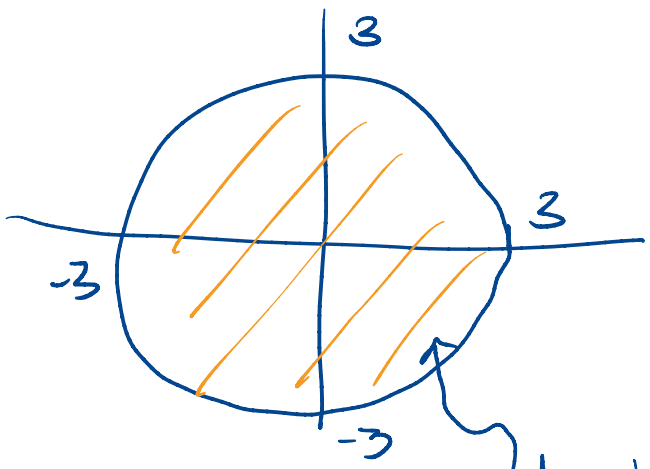
$\vec{\ell}(t) = \vec{r}(0) + t\,\vec{r}\,'(0)$

$= \langle 0, 1 \rangle + t\langle 2, -1 \rangle = \langle 2t, 1 - t \rangle$

2. Sketch the domain of $f(x, y) = \ln(9 - x^2 - y^2)$.

$\ln(z)$ is defined for $z > 0$

Need $9 - x^2 - y^2 > 0 \Rightarrow 9 > x^2 + y^2$.



$x^2 + y^2 = 9$

G circle of radius 3

domain (boarday not included)

3. Consider the function

$$f(x,y) = \frac{xy}{3x^2+y^2}.$$

- Is $(0,0)$ in the domain of this function? Why or why not?

No: $\frac{0}{0}$ is not defined.

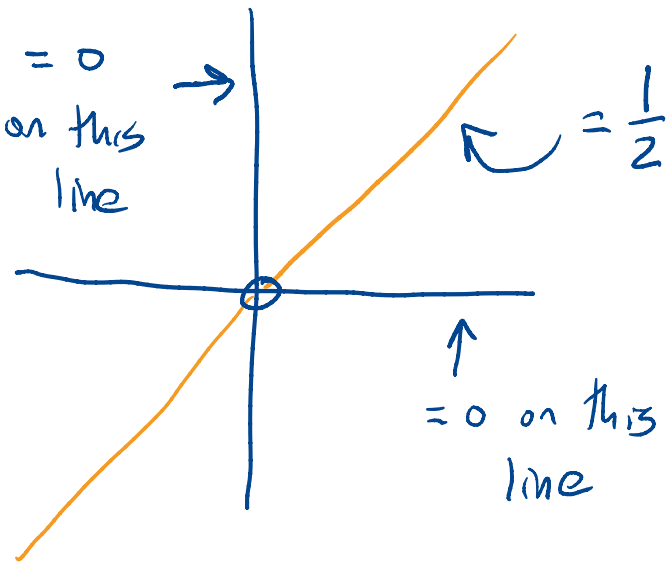
- What is the value of this function along the line $y = x$?

If $y=x$, $f(x,x) = \frac{x^2}{4x^2} = \frac{1}{4}$ $(x \neq 0)$

- What is the value of this function along the line $y = 0$?

If $y=0$ $f(x,0) = \frac{x\cdot 0}{3x^2+0} = 0$ $(x \neq 0)$

- Either compute $\lim_{(x,y)\to(0,0)} f(x,y)$ or explain clearly why this limit doesn't exist.



No limit. As $(x,y) \to (0,0)$ on line $y=0$, $f(x,y) \to 0$. But as $(x,y) \to (0,0)$ on line $y=x$, $f(x,y) \to \frac{1}{2}$