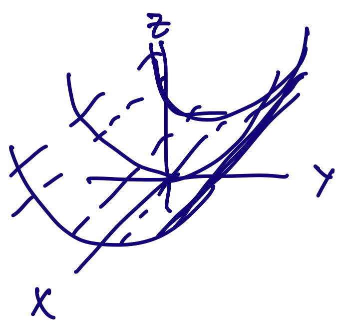
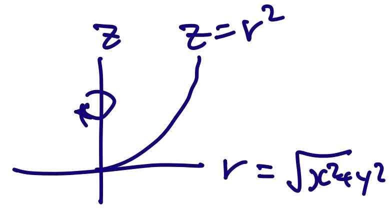
- By default, you are expected to attend a face-to-face classroom unless you are approved for either an off-campus online test or an alternative assessment.
- It is a closed book test and no calculator is allowed. It means you cannot see the lecture note/books and you cannot use calculator app. Of course, any means of communication with other people is not allowed.
- You need to bring your own device to the class to take the exam. The device should be able to access Moodle Quiz.
- You can bring blank 5 sheets of A4 paper for calculations.
- The test will cover up to Lecture Note 11.
- There will be around 5 questions (possibly with sub-questions), which are either multiple choices or short answers.
- If you need to isolate due to COVID unexpected, please join the Zoom link of Dr. Wenhui shi (https://monash.zoom.us/j/3720929930?pwd=N0o5VHZpM2FxM3RWQ1pMcFR6WW00UT09) at 12:55 pm on 11 April. When you join the Zoom Room, you need to turn on your camera and audio so that the invigilator should be able to see your face. Also, you need to follow the invigilators' directions give to you (e.g. "please show the desk and surroundings"). At 1:00 pm, the Mid Semester test will open and you can start the test. You should have reported to the University regarding the COVID isolation.
- If you are registered with DSS-qualified for extra time for assessment, you should take the test via the Zoom link. Please follow the same instruction as the unexpected COVID isolation described above. Since I can see the DSS status, you don't need any approval.

$z = y^2$

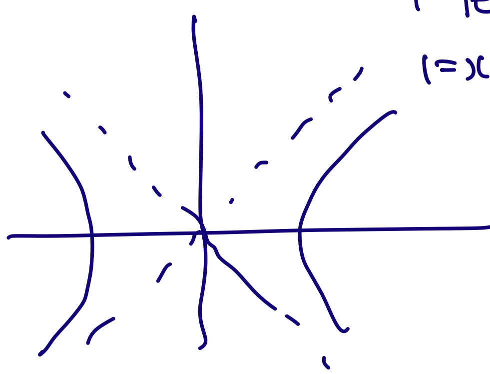


$z = x^2 + y^2$



level curve

$z = x^2 - y^2$



1- level curve

$1 = x^2 - y^2$

limit $\displaystyle \lim_{(x,y)\to(1,0)} \frac{1}{(x-1)^2+y^2}$ does not exist.

take curve $(t+1, t)$, then $\nexists \displaystyle \lim_{t\to 0} \frac{1}{t^2+t^2}$

$$\lim_{(x,y)\to(0,0)} \frac{xy^2}{x^2+y^4} \quad \text{does not exist.}$$

limit along the curve $(0,t)$ and (t^2,t)

$$\lim_{t\to 0} \frac{0}{t^4} = 0$$

$$\lim_{t\to 0} \frac{t^2 \cdot t^2}{t^4+t^4} = \frac{1}{2}$$

Squeeze thm.

If $\exists\, h(\vec{x})$ such that

$$|g(\vec{x})| \leq h(\vec{x}) \xrightarrow[\vec{x}\to\vec{x}_0]{} 0$$

Then

$$\lim_{\vec{x}\to\vec{x}_0} g(\vec{x}) = 0$$

How to find $h(\vec{x})$.

Tip ① $\quad |xy| \leq \frac{1}{2}(x^2+y^2)$

② $\quad |y|, |x| \leq \sqrt{x^2+y^2}$

③ $\quad |\cos x|, |\sin(x)| \leq 1$ or $|x|$

$$f(x,y) = \begin{cases} \dfrac{x^2y\sqrt{x^4+y^2}}{x^4+y^2} & (x,y)\neq(0,0) \\ 0 & (x,y)=(0,0) \end{cases}$$

① $f(x,y)$ is cont. at $(0,0)$

pf)

Need to show. $\lim f(x,y) = 0$

$$|f(x,y)| \leq \frac{\frac{1}{2}(x^4+y^2)\sqrt{x^4+y^2}}{x^4+y^2} = \underbrace{\boxed{\frac{1}{2}\sqrt{x^4+y^2}}}_{h(x,y)} \xrightarrow[(x,y)\to(0,0)]{} 0$$

By the squeeze thm, $\lim f(x,y) = 0$ ☑

② $(D_{\vec{v}}f)(0,0)$ when $\vec{v} = (a,b)$ with $a^2+b^2=1$

$$= \lim_{h\to 0} \frac{f(\overbrace{ah,bh}^{(0,0)+\vec{v}\cdot h}) - f(0,0)}{h}$$

$$= \lim_{h\to 0} \frac{\dfrac{a^2h^2\cdot bh\sqrt{a^4h^4+b^2h^2}}{(ah)^4+(bh)^2}}{h}$$

$$= \lim_{h\to 0} \frac{\dfrac{a^2b\sqrt{a^4h^2+b^2}}{a^4+b^2/h^2}}{h} = 0$$

③ $Lf(x,y) = 0$ since $D_{\vec{v}} f = 0$ for any $\vec{v}$

$$\begin{aligned} &\shortparallel \\ &f(0,0) + (\partial_x f)\, x \\ &\quad + (\partial_y f)\, y \end{aligned}$$

$$\lim_{(x,y)\to(0,0)} \frac{|f(x,y) - Lf(x,y)|}{\sqrt{x^2+y^2}} = \lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^4+y^2}$$

↑ limit does not exists

$x = k\sqrt{y}$

Therefore f is not differentiable.