$f(x,y) = x + 0y$ $\quad f(x,y) = y$

continuous $\quad$ continuous

- $f \pm g$

$f \cdot g$

$\frac{f}{g} \quad g \neq 0$

2. $\underbrace{\underline{x} + \underbrace{\underline{yx}}_{\text{cont}} - \underline{x^2}}_{\text{cont.}}$ $\quad x^2 = x \cdot x$ $\quad \frac{\overbrace{x + y^2}^{\text{cont}}}{\underbrace{x-y}_{\text{cont.}}}$ $\quad \boxed{x-y \neq 0}$

Cond.: is cont. for $x-y \neq 0$

f cont g cont $\rightarrow f(g)$ cont ✓

e^{x^2+y} $\quad \left.\begin{array}{l} e^z \text{ cont} \\ x^2+y \text{ cont} \end{array}\right\} e^{x^2+y}$ cont.

$\tan(\sqrt{x \cdot y})$ $\quad x \cdot y \geq 0$

$\sqrt{x \cdot y} \neq \frac{\pi}{2} + \pi \cdot k \quad k \in \mathbb{Z}$

$\left.\begin{array}{l} \sqrt{z} \text{ cont } \sqrt{xy} \text{ cont} \\ \tan s \text{ cont (domain)} \end{array}\right\} \tan\sqrt{xy}$ cont.

$\lim\limits_{(x,y)\to(1,2)} x^2 + yx = 1^2 + 2 \cdot 1 = 3$

cont.

$\lim\limits_{(x,y)\to(1,2)} \frac{x^2+yx}{x-y} = \frac{1^2 + 2 \cdot 1}{1-2} = \frac{3}{-1} = -3$

$\rightarrow$ cont. at $(1,2)$

$x-y \neq 0 \quad x \neq y$

4a

$$\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{x^2+y^2}$$

- what if $x=0$, $y \to 0$: $\lim_{y\to 0} \frac{0^2-y^2}{0^2+y^2} = -1$

$\frac{-\cancel{y^2}}{\cancel{y^2}} = -1$

- what if $y=0$, $x\to 0$: $\lim_{x\to 0} \frac{x^2-0^2}{x^2+0^2} = 1$

Conclusion: No limit

(4b)

$$\lim_{(x,y)\to(0,0)} \left(\frac{x^2-y^2}{x^2+y^2}\right)^2$$

- $x=0$, $y\to 0$: $\lim_{y\to 0} \underbrace{\left(\frac{0^2-y^2}{0^2+y^2}\right)^2}_{-1} = 1$

- $y=0$, $x\to 0$: $\lim_{x\to 0} \left(\frac{x^2-0^2}{x^2+0^2}\right)^2 = 1$

- $x=y$: $\lim_{(x,x)\to(0,0)} \left(\frac{x^2-x^2}{x^2+x^2}\right)^2 = \left(\frac{0}{2x^2}\right)^2 = 0$

$\Rightarrow$ No limit