L'Hopital's Rule

• Tool for computing limits that are "indeterminate": Expressions that can't be assigned a consistent numerical Value.

Thin: Suppose that
$$f(a), g(x)$$
 are functions
differentiable near a , $\lim_{x \to a} f(x) = \lim_{x \to a} g(x) = 0$
 $x \to a$ $x \to a$
 $\delta(\lim_{x \to a} f(x) = \pm \omega$ and $\lim_{x \to a} g(x) = \pm \omega$, and
 $x \to a$
 $g'(x) \neq 0$ (except possibly at a). Then

lim	f(x)	((lin	f'(2)	provided or is in	RHJ	exists
X-ra	g(x)		X-74	g'(x) '	or is in	Finite	

Note: we allow $\alpha = \pm uo$.

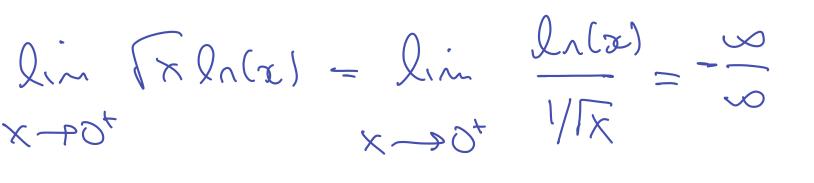
Indeterminate Form	How to Hendle
818	L'Hopital
	Reprite as % or w/w.
$\infty - \infty$	Algebra trick
	take log, recorte as 06 or 0 jus

 $\frac{f_{X}}{X \to \infty} \quad \frac{f_{X}(x)}{f_{X}} = \frac{\infty}{\infty}$ $\frac{l'H}{lin} \frac{l'x}{l_2 l_x} = lin \frac{2}{l_x} = 0.$ $\frac{l'H}{x \to \infty} \frac{1}{l_2 l_x} \frac{1}{x \to \infty} \frac{2}{l_x} = 0.$

 $\frac{E_{X}}{\sum_{x \to \infty}} \frac{1}{2} \frac{\chi^2}{e^x} = \frac{1}{2} \frac{$ $\lim_{X \to \infty} \frac{2x}{e^{X}} = \frac{0}{10} = \lim_{X \to \infty} \frac{1}{e^{X}} = 0.$

Ex: lim $\int x l_n(x) = 0.10$

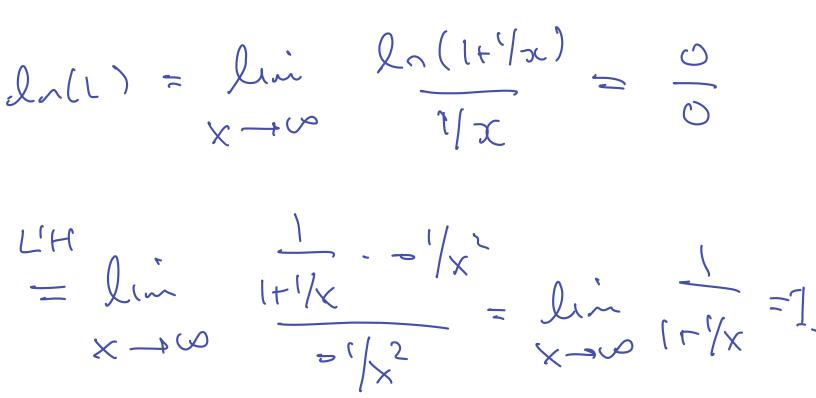
X -+ 0t



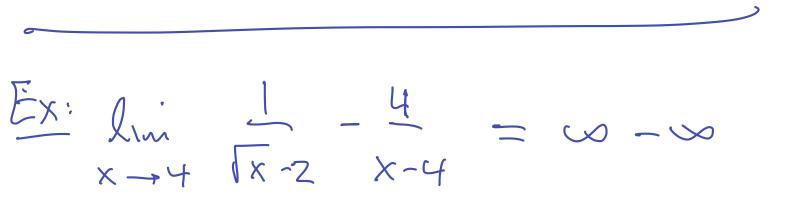
 $\frac{UH}{=} \lim_{X \to 0^{t}} \frac{1/x}{-\frac{1}{2}x^{-\frac{3}{2}}} = \lim_{X \to 0^{t}} -2\sqrt{x} = 0.$

 $\begin{array}{l} E_{X:} & \lim_{x \to \infty} \left(\frac{1+1}{x} \right)^{x} = 1^{\infty} \\ & \times - \frac{1}{2} \\ \end{array}$

 $L = \lim_{x \to \infty} (1 + 1/x)^{x} \text{ then}$ $l_{n}(L) = \lim_{X \to \infty} \chi l_{n}(1+1/x) = \infty \cdot 0$







 $\lim_{X \to 4} (x - 4) - 4(5x - 2)$

Note: $X-4 = (\int x - 2)(\int x + z)$

$$= \lim_{X \to 4} (\sqrt{x-2}) \left[(\sqrt{x+2}) - 4 \right] = \lim_{X \to 4} \sqrt{x-2}$$
$$= \sqrt{2} \frac{1}{(x-4)(\sqrt{x-2})} \frac{1}{x-4} \frac{1}{x-4}$$
$$= \sqrt{2} \frac{1}{x-4} \frac{1}{x-4} \frac{1}{x-4} \frac{1}{x-4} \frac{1}{x-4}$$

These types are usually quite hard.