$$f(x) = e^{x\cdot 3x^2 - 9x + 4}$$

$$f'(x) = e^{x - 3x^2 - 9 + 4} \cdot \underbrace{(3x^2 - 6x - 9)}_{\text{studio segno}}$$

$$3x^2 - 6x - 9 > 0$$

$$x^2 - 2x - 3 > 0$$

$$x_{1,2} \; \frac{2 \pm \sqrt{4 - 4(-3)}}{2} = \frac{2 \pm 4}{2} \left\langle \begin{array}{l} -1 \\ 3 \end{array} \right.$$

$$f(-1) = e^{-1-3+9+4} = e^{9}$$

$$(x-3)(x+1) \geq 0$$

$x > 3$

$x > -1$

	max locale -1		min locale 3	
$-$		$-$		$+$
$-$		$+$		$+$
$+$		$-$		$+$
$\nearrow$		$\searrow$		$\nearrow$

$$f(x) = \begin{cases} \dfrac{(x+1)^3}{\sin^2(x+1)} & x \neq -1 \\ \dfrac{\pi}{2} & x = -1 \end{cases}$$

$$(-1-\pi \ , -1+\pi)$$

$\sin x = 0$ se $x = 0 \pm k\pi$

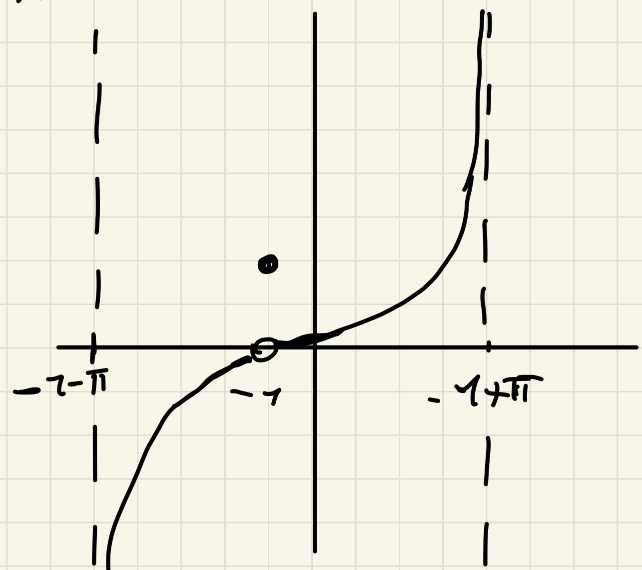
$$\left.\begin{aligned} x+1 &= \pi \qquad x = \pi - 1 \\ x+1 &= \pi \qquad x = -\pi - 1 \end{aligned}\right\} \text{non è def.}$$

$$\lim_{x \to -1^-} \frac{(x+1)^3}{\sin^2(x+1)} = \lim_{x \to -1^-} \frac{(x+1)^3}{\dfrac{\sin^2(x+1)}{(x+1)^2} \cdot (x+1)^2} = \lim_{x \to -1^-} (x+1) = 0$$

$\dfrac{\sin^2(x+1)}{(x+1)^2} \to 1$

$\dfrac{\sin x}{x} \xrightarrow{x \to 0} 1$

$$\lim_{x \to -1 \pm \pi} \frac{(x+1)^3}{\sin^2(x+1)} = \frac{\pm \pi^3}{0} = \pm\infty$$



$x_0 = 1$ ordine 2 $f(x) = \log(2x - x^2)$

$$f(x) = f(x_0) + f'(x_0)(x - x_0) + \frac{f''}{2}(x_0)(x - x_0) \;\ldots\; + \frac{f^k(x_0)}{k!}(x - x_0)^k + o\left((|x - x_0|)^k\right)$$

$f(1) = \log 1 = 0$

$f'(x) = \dfrac{2 - 2x}{2x - x^2}$ $\quad f'(1) = 0$

$f''(x) = \dfrac{-2(2x - x^2) - (2 - 2x)(2x - 2x)}{(2x - x^2)^2}$ $\quad f''(1) = -2$

$$f(x) = 0 + 0 + \frac{-2}{2}(x - 1)^2 + o(|x - 1|^2) = -(x - 1)^2 + o(|x - 1|^2)$$

Sviluppo $x_0=0$ ordine 8

$f(x) = \sin x^2$ $\quad f(g(x))$ $\quad f(x) = \sin x$

$g(x) = x^2$

$$\sin(x) = x - \frac{x^3}{6} + \frac{x^5}{5!} - \frac{x^7}{7!} + o(|x|^8)$$

$$\sin(x^2) = x^2 - \frac{x^6}{6} + \underbrace{\frac{x^{10}}{5!} - \frac{x^{14}}{7!}}_{} \; o(|x|^{16}) =$$

sono o piccoli di $|x|^8$

$$= x^2 - \frac{x^6}{6} + o(|x|^8)$$

$$\int 4x(x^2-3)^5\,dx$$

$$2\int 2x(x^2-3)^5\,dx = \cancel{2}\cdot\frac{(x^2-3)^6}{\cancel{2}3}+c$$

$$\int \cos x\, e^{(\operatorname{sen} x+1)}\,dx = e^{(\operatorname{sen} x+1)}+c$$

$$\int \frac{(\log x)^4}{x}\,dx = \frac{(\log x)^5}{5}+c$$

$$\int x^2 e^x\,dx \qquad f(x)=x^2 \quad f'(x)=2x$$

$$g'(x)=e^x \quad g(x)=e^x$$

$$x^2e^x-\int 2xe^x\,dx = x^2e^x-\left[2xe^x-\int 2e^x\,dx\right]=$$

$$x^2e^x-2xe^x+2e^x+c = e^x(x^2-2x-2)+c$$

$$\int \frac{1}{1+9x^2}\,dx = \qquad \int \frac{1}{1+x^2}\,dx = \operatorname{arctg} x + c$$

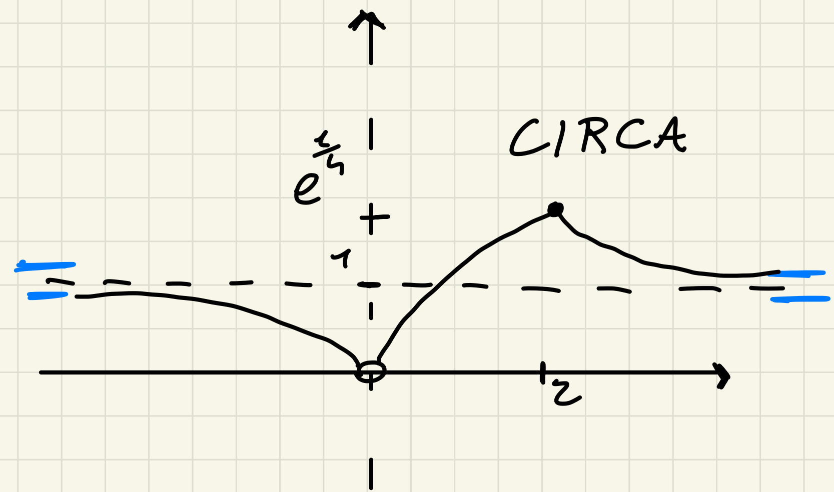
$$= \int \frac{1}{1+(3x)^2}\,dx = \frac{1}{3}\int 3 + \frac{1}{1+(3x)^2}\,dx = \frac{1}{3}\operatorname{arctg} 3x + c$$

$$f(x) = e^{\frac{x-1}{x^2}} \qquad D: (-\infty, 0) \cup (0, +\infty)$$

$$\lim_{x\to-\infty} e^{\frac{x-1}{x^2}} = \lim_{x\to-\infty} e^{\frac{1}{x}} = 1$$

$$\lim_{x\to+\infty} e^{\frac{x-1}{x^2}} = 1$$

$$\lim_{x\to 0^\pm} e^{\overbrace{\frac{x-1}{x^2}}^{\to -\infty}} = \left(\frac{1}{e^{\infty}} \right) = 0$$



$$f'(x) = \underbrace{e^{\frac{x-1}{x^2}}}_{>0} \left(\underbrace{\frac{x^2-(x-1)2x}{x^4}}_{\text{studio il segno}} \right)$$

sempre pos

$$x^2-(x-1)\,2x > 0 \qquad x^2-2x^2+2x \geq 0 \qquad 2x-x^2 \geq 0$$

$$x(2-x) \geq 0$$

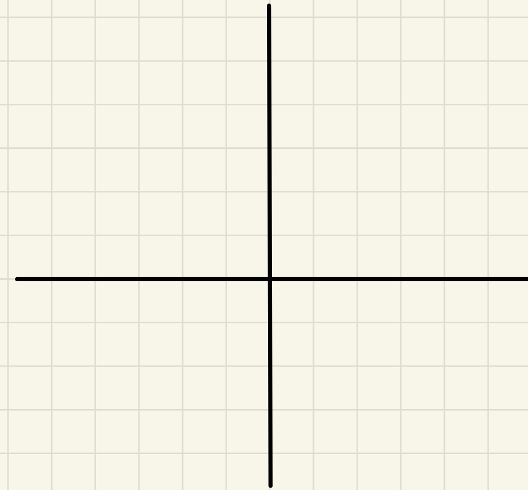
$x > 0$

$x \leq 2$

$$f(2) = e^{\frac{1}{4}}$$

	min		max	
	0		2	
$-$		$+$		$+$
$+$		$+$		$-$
↘		↗		↘

$$f(x)=\begin{cases} e^{a^2x-b} & x\leq 0 \\ \dfrac{x}{a}+a & x>0 \end{cases} \qquad a\neq 0$$



$$\lim_{x\to 0^-} e^{a^2x-b} = e^{-b}$$

$$\lim_{x\to 0^+} \frac{x}{a}+a = +a$$

per essere continua $e^{-b}=a$

$$\boxed{-b=\ln a} \qquad \boxed{a>0}$$

$$\lim_{h\to 0^-} \frac{f(x_0+h)-f(x_0)}{h} = \lim_{h\to 0^-} \frac{e^{ah^2-b}-e^{-b}}{h} = \lim_{h\to 0^-} \frac{e^{ah^2+\ln a}-e^{\ln a}}{h} =$$

$$= \lim_{h\to 0^-} \frac{ae^{a^2h}-a}{h} \qquad \underbrace{\frac{a(e^{a^2h}-1)}{a^2h}}_{\to 1} a^2 = a^3$$

$$\lim_{x \to 0^+} \frac{\frac{h}{a} + a - a}{h} = \frac{1}{a}$$

$$\frac{1}{a} = a^3$$

$$a^4 = 1$$

$$a = \pm 1$$

$a > 0$
per C.E.

$$\boxed{a = 1}$$