

$$f(x) = x^3 \ln x$$

CAMPO DI ESISTENZA $x > 0$

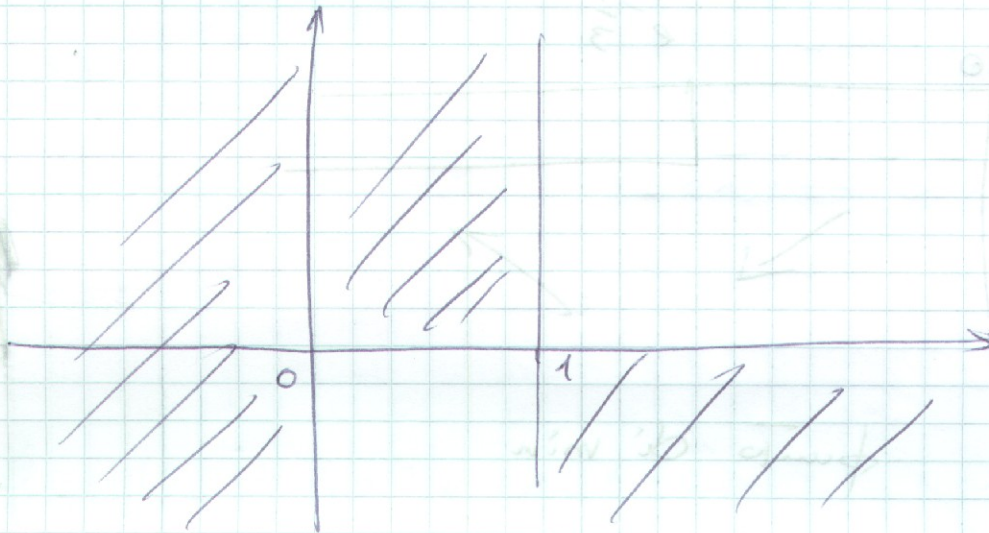
$$CE =]0, +\infty[$$

POSITIVITA'

$$\begin{cases} x > 0 \\ \ln x > 0 \end{cases}$$

$$\begin{cases} x > 0 \\ x > 1 \end{cases}$$

$$x > 1$$



Intersezione con l'asse $x \Rightarrow \begin{matrix} x=0 \\ \uparrow \\ \text{non } \in CE \end{matrix} \quad x=1$

$$\lim_{x \rightarrow 0} x^3 \ln x = 0$$

$$\lim_{x \rightarrow +\infty} x^3 \ln x = +\infty$$

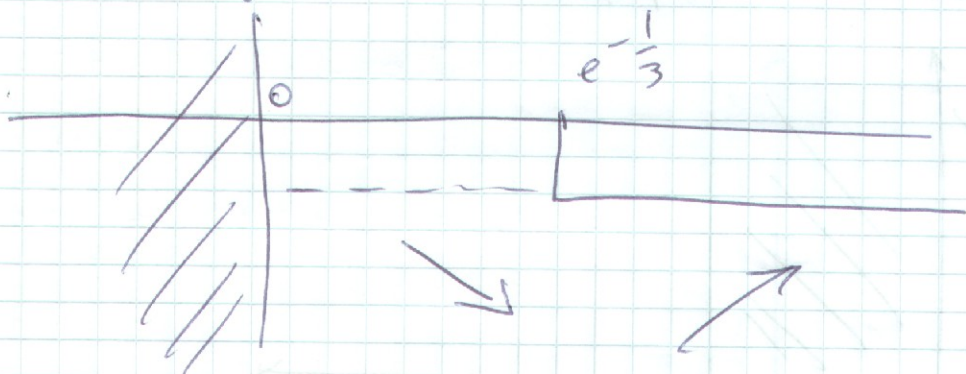
$$m = \lim_{x \rightarrow +\infty} x^2 \ln x = +\infty \quad \text{non c'è asintoto obliquo}$$

MAX E MIN

$$\begin{aligned} f'(x) &= 3x^2 \ln x + \frac{x^3}{x} = 3x^2 \ln x + x^2 = \\ &= x^2 (3 \ln x + 1) \end{aligned}$$

$$f'(x)=0 \quad \left\{ \begin{array}{l} x=0 \\ \ln x = -\frac{1}{3} \end{array} \right. \quad \left\{ \begin{array}{l} x=0 \\ x=e^{-\frac{1}{3}} \end{array} \right.$$

$$f'(x) > 0 \quad \left\{ \begin{array}{l} x > 0 \\ x > e^{-\frac{1}{3}} \end{array} \right.$$



$x = e^{-\frac{1}{3}}$ punto di min

$$f\left(e^{-\frac{1}{3}}\right) = e^{-1} \ln e^{-\frac{1}{3}} = -\frac{1}{3e}$$

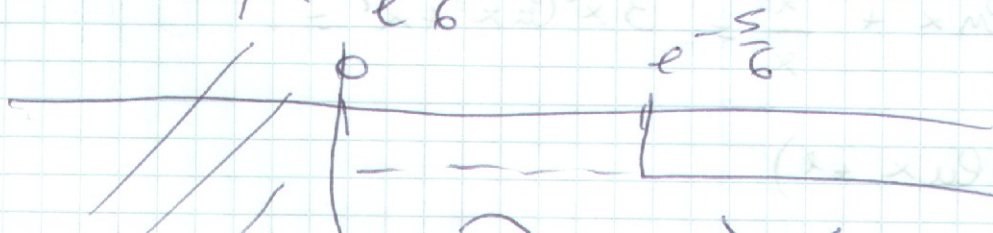
CONCAVITA' E CONVESSITA'

$$f''(x) = 2x(3\ln x + 1) + x^2\left(\frac{3}{x}\right) =$$

$$= 6x \ln x + 2x + 3x =$$

$$= 6x \ln x + 5x = x(6 \ln x + 5)$$

$$f''(x)=0 \quad \left\{ \begin{array}{l} x=0 \\ x = -\frac{5}{6} \end{array} \right.$$



$f(x) = \frac{e^{-x}}{x^2}$

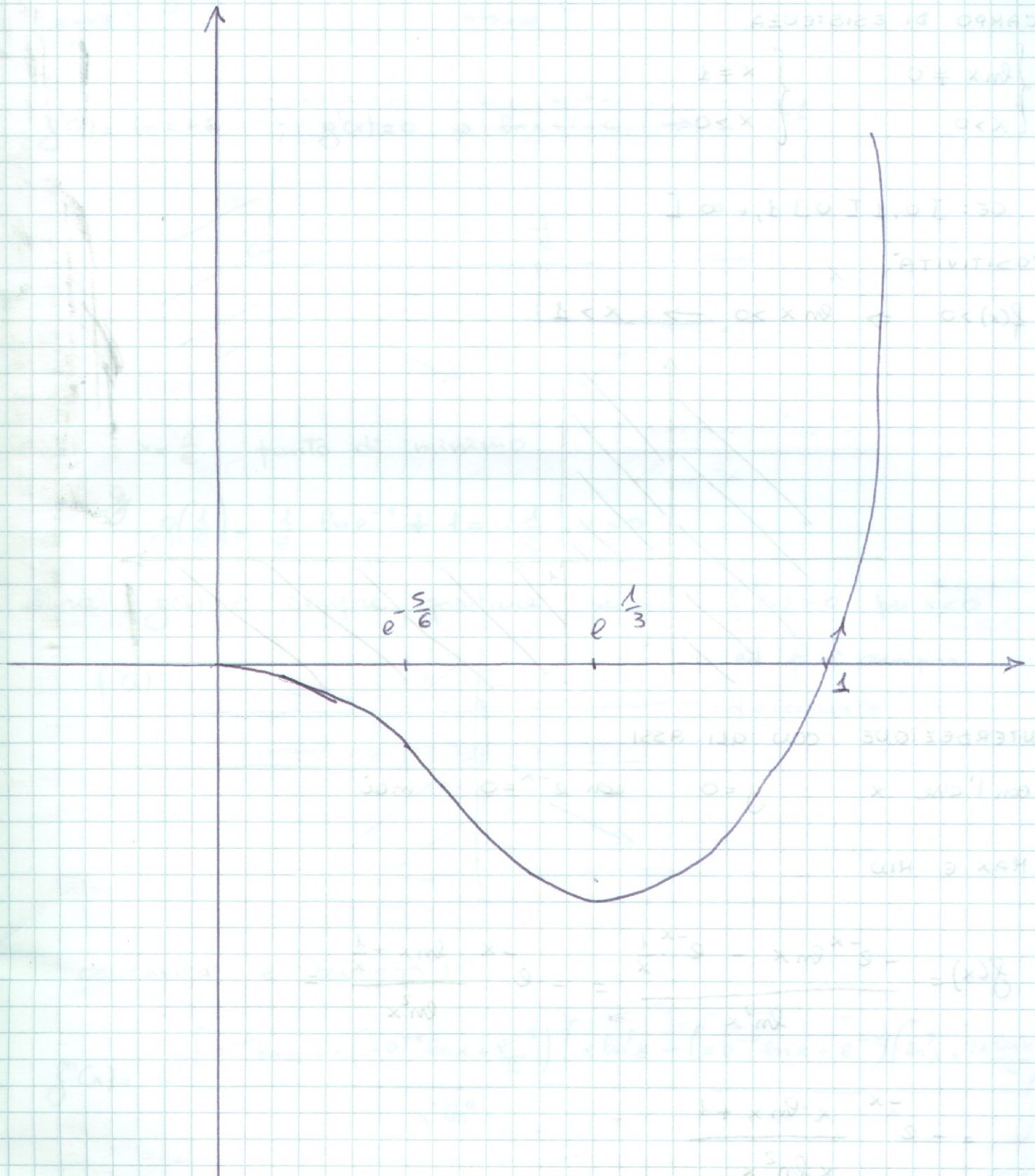
CAMPO DI ESISTENZA

$x \neq 0$
 $x > 0$
 $x < 0$

CE: $]-\infty, 0[\cup]0, +\infty[$

POSITIVITA'

$f(x) > 0 \iff x > 0$
 $f(x) < 0 \iff x < 0$



$-\frac{5}{6}$

$\frac{1}{3}$

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INTERSEZIONE CON GLI ASSI

$f(x) = 0 \iff x = 0$
 $f(x) = 1 \iff x = 1$

MAX E MIN

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

$f''(x) = \frac{e^{-x}(x^2 + 2x)}{x^4}$