

gráfico  $f$

Dom  $f$

$f'$  analisa sinal

cus/dec  $f$

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$f''$  analisa Sinal

Concavidade de  $f$

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limites ( $+\infty$ ,  $-\infty$ , pontos 'suavizados'  
cus dom  $f$ )

assintotas  $p/+\infty$ ,  $-\infty$  (se for necessário  
achamos assintotas  
horizontais)

93.8

$$f(x) = x^5 + bx^4 + cx^3 - 2x + 1$$

a) Que condições  $b$  e  $c$  devem satisfazer para que 1 seja ponto de inflexão horizontal? Em caso afirmativo, determine-o.

Sol:  $f'(x) = 5x^4 + 4bx^3 + 3cx^2 - 2$

$$f'(1) = 5 + 4b + 3c - 2$$

$$f''(x) = 20x^3 + 12bx^2 + 6cx$$

$$f''(1) = 20 + 12b + 6c$$

$$\begin{cases} f'(1) = 0 \\ f''(1) = 0 \end{cases} \Leftrightarrow \begin{cases} 4b + 3c = -3 \\ 12b + 6c = -20 \end{cases} \Leftrightarrow \begin{cases} 4b + 3c = -3 \\ 6b + 3c = -10 \end{cases}$$

$$\Leftrightarrow \begin{cases} 4b + 3c = -3 \\ 2b = -7 \end{cases} \Leftrightarrow \begin{cases} c = \frac{1}{3}(-3 - 4b) = \frac{1}{3}(-3 + 14) \\ b = -\frac{7}{2} \end{cases} \quad \begin{matrix} c = \frac{11}{3} \\ b = -\frac{7}{2} \end{matrix}$$

$$f''(x) = 20x^3 + 12\left(-\frac{7}{2}\right)x^2 + 6\left(\frac{11}{3}\right)x$$

$$= 20x^3 - 42x^2 + 22x$$

$$= 2x(10x^2 - 21x + 11)$$

$$= 2x(x-1)(10x-11)$$

$$\begin{array}{r} 10x^2 - 2x + 11 \quad | \quad x - 1 \\ -10x^2 + 10x \quad \quad \quad | \quad 10x - 11 \\ \hline -11x + 11 \\ +11x - 11 \\ \hline 0 \end{array}$$

1) (emb)

		0		1		11	
		0	+	+	+	+	+
2x	-	0	+	0	-	0	+
(x-1)(10x-1)	+	+	+	0	+	+	+
f''(x)	-	0	+	0	+	+	+

↑
↑
↑  
 P.I

$$b = -\frac{7}{2}$$

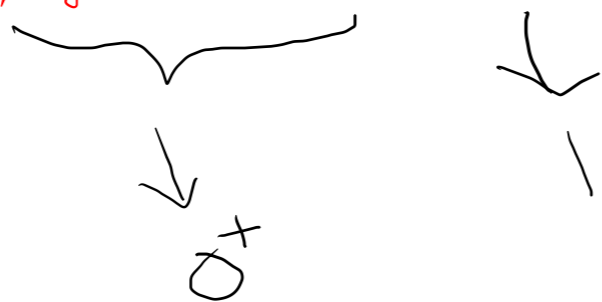
$$c = \frac{11}{3}$$

9.4 (2)

$$\lim_{x \rightarrow 0} \frac{\sin 3x - \sin x}{\sin^3 x} \stackrel{L'H}{=} \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{\sin^2(3x) \cdot 3 - \cos x}{3 \sin^2 x \cdot \cos x} = +\infty \Rightarrow 3-1 \neq 0$$

$$3 \sin^2 x \cdot \cos x$$



OBS: N PODE  
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DE N V

$$\lim_{x \rightarrow 0} \frac{\sin x - \sin x}{\sin^3 x} \stackrel{L'H}{=} \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{\sin^2 x - \cos x}{3 \sin^2 x \cos x} = \frac{1}{2}$$

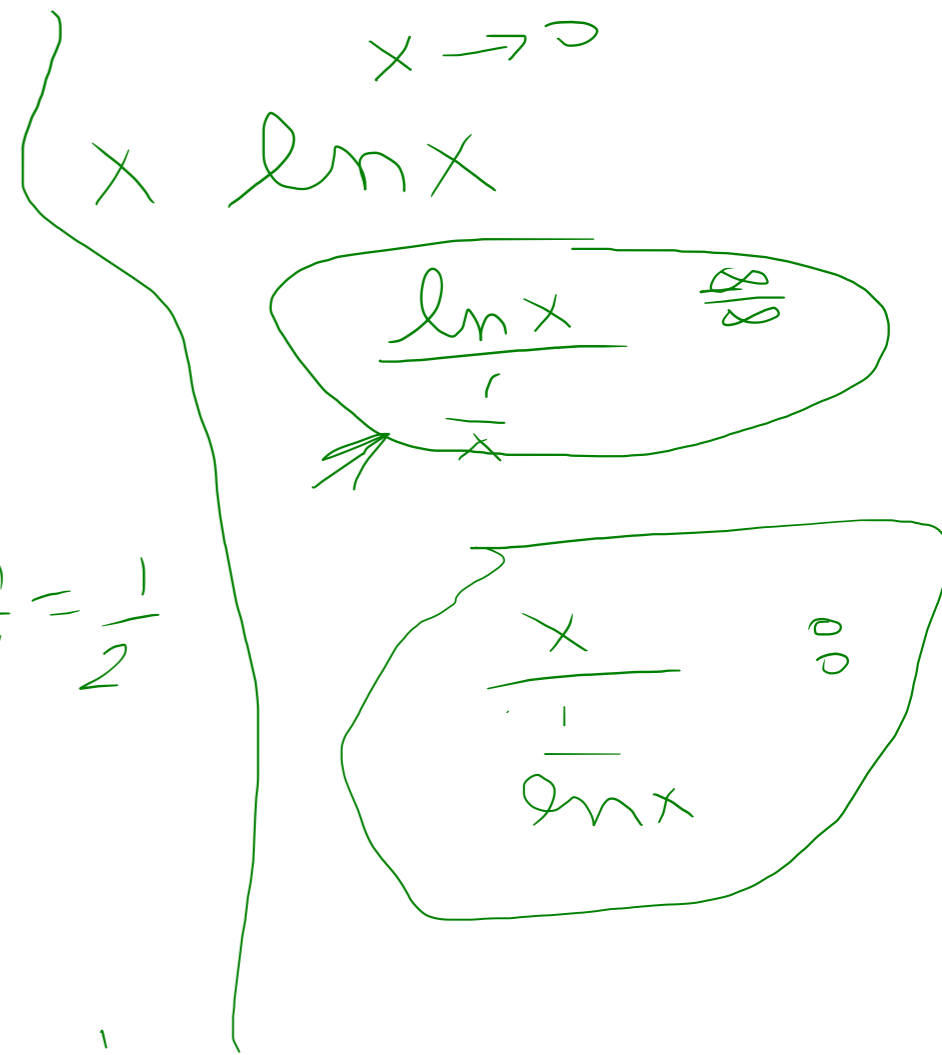
$$\star \lim_{x \rightarrow 0} \frac{\sec^2 x - \cos x}{3 \sec^2 x} \stackrel{\text{L'H}}{=} \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{2 \sec x \cdot \sec x + \sin x + \sin x}{6 \sin x \cos x}$$

$$= \lim_{x \rightarrow 0} \frac{2 \sec^2 x \tan x + \sin x}{6 \sin x \cos x} = \frac{1}{2} \cdot \frac{1}{1} = \frac{1}{2}$$

$$\star \lim_{x \rightarrow 0} \frac{2 \sec^2 x \tan x + \sin x}{6 \sin x} \stackrel{\text{L'H}}{=} \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{2 \sec x \cdot \sec x + \tan x + \tan x + 2 \sec^2 x \sec^2 x + \cos x}{6 \cos x} = \frac{3}{6} = \frac{1}{2}$$



94 (2)

$$\lim_{x \rightarrow 0^-} (1 - \cos x)^{\frac{1}{x}} = \lim_{x \rightarrow 0} e$$

$$\ln(1 - \cos x) \cdot \frac{1}{x}$$

$= +\infty$

$\downarrow$   
 $+\infty$

$$\star \lim_{x \rightarrow 0^-} \frac{\ln(1 - \cos x)}{x} = +\infty$$

$$\lim_{x \rightarrow 0^-} (\cos x)^{\frac{1}{x}} = \lim_{x \rightarrow 0^-} e$$

$$\ln(\cos x) \cdot \frac{1}{x}$$

$\rightarrow 0$   
 $\star = e^0 = 1$

$$\star \lim_{x \rightarrow 0^-} \frac{\ln \cos x}{x} \stackrel{[0/0]}{=} \lim_{x \rightarrow 0^-} \frac{\frac{1}{\cos x} \cdot \Delta \ln x}{1} = 0$$

9.2.4