gráfico f

dom f

f' analisa sinal
cres/dec f

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f'' analisa sinal
concavidade de f

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limites (+∞, −∞, pontos 'suspeitos'
no dom f)

assíntotas p/ +∞, −∞ (se já não
achamos assíntotas
horizontais

9.3.8 $\quad f(x) = x^5 + bx^4 + cx^3 - 2x + 1$

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

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

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

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

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

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

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

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

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

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

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

$$\begin{array}{l|l} 10x^2 - 21x + 11 & x - 1 \\ \hline -10x^2 + 10x & 10x - 11 \\ \quad -11x + 11 & \\ \quad +11x - 11 & \\ \hline \quad\quad 0 & \end{array}$$

(item b)

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

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

		0		1		$\frac{11}{10}$	
			+	+	+	+	+
$2x$	−	0	+	+	−	0	+
$(x-1)(10x-1)$	+	+	+	0	−	0	+
$f''(x)$	−	0	+	0	−	0	+

p. 1

9.4 (l)

$$\lim_{x \to 0} \frac{\operatorname{tg} 3x - \operatorname{sen} x}{\operatorname{sen}^3 x} \left[\frac{0}{0}\right] \overset{L'H}{=}$$

$$= \lim_{x \to 0} \frac{\sec^2(3x).3 - \cos x}{\underbrace{3\operatorname{sen}^2 x}_{\to 0^+} . \underbrace{\cos x}_{\to 1}} \to 3-1>0 \quad = +\infty$$

OBS: N PODE USAR L'HOSPITAL DE NOVO

$$\lim_{x \to 0} \frac{\operatorname{tg} x - \operatorname{sen} x}{\operatorname{sen}^3 x} \left[\frac{0}{0}\right] \overset{L'H}{=} \lim_{x \to 0} \frac{\sec^2 x - \cos x}{3\operatorname{sen}^2 x \cos x} = \frac{1}{2}$$

$\to \frac{1}{2}$

★ $$\lim_{x\to 0} \frac{\sec^2 x - \cos x}{3\sin^2 x} \left[\frac{0}{0}\right] \overset{L'H}{=}$$

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

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

* $$\lim_{x\to 0} \frac{2\sec^2 x \tan x + \sin x}{6\sin x} \left[\frac{0}{0}\right] \overset{L'H}{=}$$

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

($\tan x \tan x \to 0$, $2\sec^2 x \sec^2 x \to 2$, $\cos x \to 1$)

$x \to 0$

$x \ln x$

$$\frac{\ln x}{\frac{1}{x}} \quad \frac{\infty}{\infty}$$

$$\frac{x}{\frac{1}{\ln x}} \quad \frac{0}{0}$$

94 (g)

$$\lim_{x\to 0^-}(1-\cos x)^{\frac{1}{x}} = \lim_{x\to 0^-} e^{\ln(1-\cos x)\cdot\frac{1}{x}} = +\infty$$

$\ln(1-\cos x)\cdot\frac{1}{x} \to +\infty$ *

$\to -\infty$

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

$x \to 0^-$

$$\lim_{x\to 0^-}(\cos x)^{\frac{1}{x}} = \lim_{x\to 0^-} e^{\ln(\cos x)\cdot\frac{1}{x}} \overset{*}{=} e^0 = 1$$

$\to 0$

$$* \lim_{x\to 0^-}\frac{\ln\cos x}{x} \overset{[\frac{0}{0}]}{=} \lim_{x\to 0^-}\frac{\frac{1}{\cos x}\cdot \sin x}{1} = 0$$

9.2.4