Limites Trigonométricos Resolvidos

Sete páginas e 34 limites resolvidos

Usar o limite fundamental e alguns artifícios : $\lim_{x\to 0}\frac{senx}{x}=1$

1. $\lim_{x\to 0}\frac{x}{\text{sen }x}=?$ **à** $\lim_{x\to 0}\frac{x}{\text{sen }x}=\frac{0}{0}$, é uma indeterminação.

$\lim_{x\to 0}\frac{x}{\text{sen }x}=\lim_{x\to 0}\frac{1}{\frac{\text{sen }x}{x}}=\frac{1}{\lim_{x\to 0}\frac{\text{sen }x}{x}}=1$ logo $\lim_{x\to 0}\frac{x}{\text{sen }x}=1$

2. $\lim_{x\to 0}\frac{\text{sen }4x}{x}=?$ **à** $\lim_{x\to 0}\frac{\text{sen }4x}{x}=\frac{0}{0}$ **à** $\lim_{x\to 0}4.\frac{\text{sen }4x}{4x}=4.\lim_{y\to 0}\frac{\text{sen }y}{y}=4.1=4$ logo $\lim_{x\to 0}\frac{\text{sen }4x}{x}=4$

3. $\lim_{x\to 0}\frac{\text{sen }5x}{2x}=?$ **à** $\lim_{x\to 0}\frac{5}{2}.\frac{\text{sen }5x}{5x}=\lim_{y\to 0}\frac{5}{2}.\frac{\text{sen }y}{y}=\frac{5}{2}$ logo $\lim_{x\to 0}\frac{\text{sen }5x}{2x}=\frac{5}{2}$

4. $\lim_{x\to 0}\frac{\text{sen }mx}{nx}=?$ **à** $\lim_{x\to 0}\frac{\text{sen }mx}{nx}=\lim_{x\to 0}\frac{m}{n}.\frac{\text{sen }mx}{mx}=\frac{m}{n}.\lim_{y\to 0}\frac{\text{sen }y}{y}=\frac{m}{n}.1=\frac{m}{n}$ logo $\lim_{x\to 0}\frac{\text{sen }mx}{nx}=\frac{m}{n}$

5. $\lim_{x\to 0}\frac{\text{sen }3x}{\text{sen }2x}=?$ **à** $\lim_{x\to 0}\frac{\text{sen }3x}{\text{sen }2x}=\lim_{x\to 0}\frac{\frac{\text{sen }3x}{x}}{\frac{\text{sen }2x}{x}}=\lim_{x\to 0}\frac{3.\frac{\text{sen }3x}{3x}}{2.\frac{\text{sen }2x}{2x}}=.\frac{\lim_{x\to 0}\frac{\text{sen }3x}{3x}}{\lim_{x\to 0}\frac{\text{sen }2x}{2x}}=\frac{3}{2}.\frac{\lim_{y\to 0}\frac{\text{sen }y}{y}}{\lim_{t\to 0}\frac{\text{sen }t}{t}}=\frac{3}{2}.1=\frac{3}{2}$ logo $\lim_{x\to 0}\frac{\text{sen }3x}{\text{sen }2x}=\frac{3}{2}$

6. $\lim_{x\to 0}\frac{senmx}{sennx}=?$ **à** $\lim_{x\to 0}\frac{\text{sen }mx}{\text{sen }nx}=\lim_{x\to 0}\frac{\frac{\text{sen }mx}{x}}{\frac{\text{sen }nx}{x}}=\lim_{x\to 0}\frac{m.\frac{\text{sen }mx}{mx}}{n.\frac{\text{sen }nx}{nx}}=\lim_{x\to 0}\frac{m}{n}.\frac{\frac{\text{sen }mx}{mx}}{\frac{\text{sen }nx}{nx}}=\frac{m}{n}$ Logo $\lim_{x\to 0}\frac{senmx}{sennx}=\frac{m}{n}$

7. $\lim_{x\to 0}\frac{tgx}{x}=?$ **à** $\lim_{x\to 0}\frac{tgx}{x}=\frac{0}{0}$ **à** $\lim_{x\to 0}\frac{tgx}{x}=\lim_{x\to 0}\frac{\frac{\text{sen }x}{\cos x}}{x}=\lim_{x\to 0}\frac{\text{sen }x}{\cos x}.\frac{1}{x}=$ $\lim_{x\to 0}\frac{\text{sen }x}{x}.\frac{1}{\cos x}=\lim_{x\to 0}\frac{\text{sen }x}{x}.\lim_{x\to 0}\frac{1}{\cos x}=1$ Logo $\lim_{x\to 0}\frac{tgx}{x}=1$

8. $\lim_{a\to 1}\frac{tg\left(a^2-1\right)}{a^2-1}=?$ **à** $\lim_{a\to 1}\frac{tg\left(a^2-1\right)}{a^2-1}=\frac{0}{0}$ **à** Fazendo $t=a^2-1, \begin{cases}x\to 1\\ t\to 0\end{cases}$ **à** $\lim_{t\to 0}\frac{tg(t)}{t}=1$ logo $\lim_{a\to 1}\frac{tg\left(a^2-1\right)}{a^2-1}=1$

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9. $\lim\limits_{x\to 0}\dfrac{x-\operatorname{sen}3x}{x+\operatorname{sen}2x}=\ ?$ à $\lim\limits_{x\to 0}\dfrac{x-\operatorname{sen}3x}{x+\operatorname{sen}2x}=\dfrac{0}{0}$ à $f(x)=\dfrac{x-\operatorname{sen}3x}{x+\operatorname{sen}2x}=\dfrac{x.\left(1-\dfrac{\operatorname{sen}3x}{x}\right)}{x.\left(1+\dfrac{\operatorname{sen}5x}{x}\right)}=$

$\dfrac{x.\left(1-3.\dfrac{\operatorname{sen}3x}{3.x}\right)}{x.\left(1+5.\dfrac{\operatorname{sen}5x}{5.x}\right)}=\dfrac{1-3.\dfrac{\operatorname{sen}3x}{3.x}}{1+5.\dfrac{\operatorname{sen}5x}{5.x}}$ à $\lim\limits_{x\to 0}\dfrac{1-3.\dfrac{\operatorname{sen}3x}{3.x}}{1+5.\dfrac{\operatorname{sen}5x}{5.x}}=\dfrac{1-3}{1+5}=\dfrac{-2}{6}=-\dfrac{1}{3}$ logo

$\lim\limits_{x\to 0}\dfrac{x-\operatorname{sen}3x}{x+\operatorname{sen}2x}=-\dfrac{1}{3}$

10. $\lim\limits_{x\to 0}\dfrac{tgx-\operatorname{sen}x}{x^3}=\ ?$ à $\lim\limits_{x\to 0}\dfrac{tgx-\operatorname{sen}x}{x^3}=\lim\limits_{x\to 0}\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{\cos x}.\dfrac{\operatorname{sen}^2 x}{x^2}.\dfrac{1}{1+\cos x}=\dfrac{1}{2}$

$f(x)=\dfrac{tgx-\operatorname{sen}x}{x^3}=\dfrac{\dfrac{\operatorname{sen}x}{\cos x}-\operatorname{sen}x}{x^3}=\dfrac{\dfrac{\operatorname{sen}x-\operatorname{sen}x.\cos x}{\cos x}}{x^3}=\dfrac{\operatorname{sen}x.(1-\cos x)}{x^3.\cos x}=\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{x^2}.\dfrac{1-\cos x}{\cos x}=$

$\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{x^2}.\dfrac{1-\cos x}{\cos x}.\dfrac{1+\cos x}{1+\cos x}=\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{\cos x}.\dfrac{1-\cos^2 x}{x^2}.\dfrac{1}{1+\cos x}=\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{\cos x}.\dfrac{\operatorname{sen}^2 x}{x^2}.\dfrac{1}{1+\cos x}$

Logo $\lim\limits_{x\to 0}\dfrac{tgx-\operatorname{sen}x}{x^3}=\dfrac{1}{2}$

11. $\lim\limits_{x\to 0}\dfrac{\sqrt{1+tgx}-\sqrt{1+\operatorname{sen}x}}{x^3}=?$ à $\lim\limits_{x\to 0}\dfrac{tgx-\operatorname{sen}x}{x^3}.\dfrac{1}{\sqrt{1+tgx}+\sqrt{1+\operatorname{sen}x}}=$

$\lim\limits_{x\to 0}\dfrac{\operatorname{sen}x}{x}.\dfrac{1}{\cos x}.\dfrac{\operatorname{sen}^2 x}{x^2}.\dfrac{1}{1+\cos x}.\dfrac{1}{\sqrt{1+tgx}+\sqrt{1+\operatorname{sen}x}}=1.\dfrac{1}{1}.\dfrac{1}{1}.\dfrac{1}{2}.\dfrac{1}{2}=\dfrac{1}{4}$

$f(x)=\dfrac{\sqrt{1+tgx}-\sqrt{1+senx}}{x^3}=\dfrac{1+tgx-1-\operatorname{sen}x}{x^3}.\dfrac{1}{\sqrt{1+tgx}+\sqrt{1+\operatorname{sen}x}}=\dfrac{tgx-\operatorname{sen}x}{x^3}.\dfrac{1}{\sqrt{1+tgx}+\sqrt{1+\operatorname{sen}x}}$

$\lim\limits_{x\to 0}\dfrac{\sqrt{1+tgx}-\sqrt{1+\operatorname{sen}x}}{x^3}=\dfrac{1}{4}$

12. $\lim\limits_{x\to a}\dfrac{\operatorname{sen}x-\operatorname{sen}a}{x-a}=\ ?$ à $\lim\limits_{x\to a}\dfrac{\operatorname{sen}x-\operatorname{sen}a}{x-a}=\lim\limits_{x\to a}\dfrac{2\operatorname{sen}\left(\dfrac{x-a}{2}\right).\cos\left(\dfrac{x+a}{2}\right)}{2.\left(\dfrac{x-a}{2}\right)}=$

$\lim\limits_{x\to a}\dfrac{2\operatorname{sen}(\dfrac{x-a}{2})}{2.\left(\dfrac{x-a}{2}\right)}.\dfrac{.\cos\left(\dfrac{x+a}{2}\right)}{1}=\cos a$ Logo $\lim\limits_{x\to a}\dfrac{\operatorname{sen}x-\operatorname{sen}a}{x-a}=\text{cosa}$

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13. $\lim_{a\to 0}\frac{\operatorname{sen}(x+a)-\operatorname{sen}x}{a}=?$ **à** $\lim_{a\to 0}\frac{\operatorname{sen}(x+a)-\operatorname{sen}x}{a}=\lim_{a\to a}\frac{2\operatorname{sen}\left(\frac{x+a-x}{2}\right)}{2.\left(\frac{x-a}{2}\right)}.\frac{.\cos\left(\frac{x+a+x}{2}\right)}{1}=$

$\lim_{a\to a}\frac{2\operatorname{sen}\left(\frac{a}{2}\right)}{2.\left(\frac{a}{2}\right)}.\frac{.\cos\left(\frac{2x+a}{2}\right)}{1}=\cos x$ Logo $\lim_{a\to 0}\frac{\operatorname{sen}(x+a)-\operatorname{sen}x}{a}=$cosx

14. $\lim_{a\to 0}\frac{\cos(x+a)-\cos x}{a}=?$ **à** $\lim_{a\to 0}\frac{\cos(x+a)-\cos x}{a}=\lim_{a\to 0}\frac{-2\operatorname{sen}\left(\frac{x+a+x}{2}\right).\operatorname{sen}\left(\frac{x-a-x}{2}\right)}{a}=$

$\lim_{a\to 0}\frac{-2.\operatorname{sen}\left(\frac{2x+a}{2}\right).\operatorname{sen}\left(\frac{-a}{2}\right)}{2.\left(\frac{-a}{2}\right)}=\lim_{a\to 0}-\operatorname{sen}\left(\frac{2x+a}{2}\right).\frac{\operatorname{sen}\left(\frac{-a}{2}\right)}{\left(\frac{-a}{2}\right)}=-\operatorname{sen}x$ Logo

$\lim_{a\to 0}\frac{\cos(x+a)-\cos x}{a}=$-senx

15. $\lim_{x\to a}\frac{\sec x-\sec a}{x-a}=?$ **à** $\lim_{x\to a}\frac{\sec x-\sec a}{x-a}=\lim_{x\to a}\frac{\frac{1}{\cos x}-\frac{1}{\cos a}}{x-a}=\lim_{x\to a}\frac{\frac{\cos a-\cos x}{\cos x.\cos a}}{x-a}=$

$\lim_{x\to a}\frac{\cos a-\cos x}{(x-a).\cos x.\cos a}=\lim_{x\to a}\frac{-2.\operatorname{sen}\left(\frac{a+x}{2}\right).\operatorname{sen}\left(\frac{a-x}{2}\right)}{(x-a).\cos x.\cos a}=$

$\lim_{x\to a}\frac{-2.\operatorname{sen}\left(\frac{a+x}{2}\right)}{1}.\frac{\operatorname{sen}\left(\frac{a-x}{2}\right)}{-2.\left(\frac{a-x}{2}\right)}.\frac{1}{\cos x.\cos a}=\lim_{x\to a}\frac{\operatorname{sen}\left(\frac{a+x}{2}\right)}{1}.\frac{\operatorname{sen}\left(\frac{a-x}{2}\right)}{\left(\frac{a-x}{2}\right)}.\frac{1}{\cos x.\cos a}=$

$\frac{\operatorname{sen}a}{1}.1.\frac{1}{\cos a.\cos a}=\frac{\operatorname{sen}a}{\cos a}.\frac{1}{\cos a}=tga.\sec a$ Logo $\lim_{x\to a}\frac{\sec x-\sec a}{x-a}=tga.\sec a$

16. $\lim_{x\to 0}\frac{x^2}{1-\sec x}=?$ **à** $\lim_{x\to 0}\frac{x^2}{1-\sec x}=\lim_{x\to 0}\frac{1}{-\frac{\operatorname{sen}^2 x}{x^2}.\frac{1}{\cos x}.\frac{1}{(1+\cos x)}}=$

$f(x)=\frac{x^2}{1-\frac{1}{\cos x}}=\frac{x^2}{\frac{\cos x-1}{\cos x}}=\frac{x^2.\cos x}{-1.(1-\cos x)}=\frac{1}{-\frac{(1-\cos x)}{x^2}.\frac{1}{\cos x}.\frac{(1+\cos x)}{(1+\cos x)}}=$

$\frac{1}{-\frac{1-\cos^2 x}{x^2}.\frac{1}{\cos x}.\frac{1}{(1+\cos x)}}=\frac{1}{-\frac{\operatorname{sen}^2 x}{x^2}.\frac{1}{\cos x}.\frac{1}{(1+\cos x)}}$

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17. $\lim\limits_{x\to\frac{p}{4}} \frac{1-\cot gx}{1-tgx} = ?$ **à** $\lim\limits_{x\to\frac{p}{4}} \frac{1-\cot gx}{1-tgx} = \lim\limits_{x\to\frac{p}{4}} \frac{1-\frac{1}{tgx}}{1-tgx} = \lim\limits_{x\to\frac{p}{4}} \frac{\frac{tgx-1}{tgx}}{1-tgx} =$

$\lim\limits_{x\to\frac{p}{4}} \frac{\frac{-1.(1-tgx)}{tgx}}{1-tgx} = \lim\limits_{x\to\frac{p}{4}} -\frac{1}{tgx} = -1$ Logo $\lim\limits_{x\to\frac{p}{4}} \frac{1-\cot gx}{1-tgx} = -1$

18. $\lim\limits_{x\to 0} \frac{1-\cos^3 x}{\text{sen}^2 x} = ?$ **à** $\lim\limits_{x\to 0} \frac{1-\cos^3 x}{\text{sen}^2 x} = \lim\limits_{x\to 0} \frac{(1-\cos x).(1+\cos x+\cos^2 x)}{1-\cos^2 x} =$

$\lim\limits_{x\to 0} \frac{(1-\cos x).(1+\cos x+\cos^2 x)}{(1-\cos x).(1+\cos x)} = \lim\limits_{x\to 0} \frac{1+\cos x+\cos^2 x}{1+\cos x} = \frac{3}{2}$ Logo $\lim\limits_{x\to 0} \frac{1-\cos^3 x}{\text{sen}^2 x} = \frac{3}{2}$

19. $\lim\limits_{x\to\frac{p}{3}} \frac{\text{sen}\,3x}{1-2.\cos x} = ?$ **à** $\lim\limits_{x\to\frac{p}{3}} \frac{\text{sen}\,3x}{1-2.\cos x} = \lim\limits_{x\to\frac{p}{3}} -\frac{\text{sen}\,x.(1+2.\cos x)}{1} = -\sqrt{3}$

$f(x) = \frac{\text{sen}\,3x}{1-2.\cos x} = \frac{\text{sen}(x+2x)}{1-2.\cos x} = \frac{\text{sen}\,x.\cos 2x+\text{sen}\,2x.\cos x}{1-2.\cos x} = \frac{\text{sen}\,x.(2\cos^2 x-1)+2.\text{sen}\,x.\cos x.\cos x}{1-2.\cos x} =$

$\frac{\text{sen}\,x.[(2\cos^2 x-1)+2\cos^2 x]}{1-2.\cos x} = \frac{\text{sen}\,x.[4\cos^2 x-1]}{1-2.\cos x} = -\frac{\text{sen}\,x.(1-2.cox).(1+2.cox)}{1-2.\cos x} = -\frac{\text{sen}\,x.(1+2.\cos x)}{1}$

20. $\lim\limits_{x\to p/4} \frac{\text{sen}\,x-\cos x}{1-tgx} = ?$ **à** $\lim\limits_{x\to p/4} \frac{\text{sen}\,x-\cos x}{1-tgx} = \lim\limits_{x\to p/4}(-\cos x) = -\frac{\sqrt{2}}{2}$

$f(x) = \frac{\text{sen}\,x-\cos x}{1-tgx} = \frac{\text{sen}\,x-\cos x}{1-\frac{\text{sen}\,x}{\cos x}} = \frac{\text{sen}\,x-\cos x}{1-\frac{\text{sen}\,x}{\cos x}} = \frac{\text{sen}\,x-\cos x}{\frac{\cos x-\text{sen}\,x}{\cos x}} = \frac{\text{sen}\,x-\cos x}{\frac{-1.(\text{sen}\,x-\cos x)}{\cos x}} =$

$-\frac{\text{sen}\,x-\cos x}{1}.\frac{\cos x}{\cos x-\text{sen}\,x} = -\cos x$

21. $\lim\limits_{x\to 3}(3-x).\cos\sec(px) = ?$ **à** $\lim\limits_{x\to 3}(3-x).\cos\sec(px) = 0.\infty$

$f(x) = (3-x).\cos\sec(px) = (3-x).\frac{1}{\text{sen}(px)} = \frac{3-x}{\text{sen}(p-px)} = \frac{3-x}{\text{sen}(3p-px)} = \frac{1}{\frac{p.\text{sen}(3p-px)}{p.(3-x)}} =$

$\frac{1}{\frac{p.\text{sen}(3p-px)}{(3p-px)}}$ **à** $\lim\limits_{x\to 3}(3-x).\cos\sec(px) = \lim\limits_{x\to 3} \frac{1}{\frac{p.\text{sen}(3p-px)}{(3p-px)}} = \frac{1}{p}$

22. $\lim\limits_{x\to\infty} x.\text{sen}(\frac{1}{x}) = ?$ **à** $\lim\limits_{x\to\infty} x.\text{sen}(\frac{1}{x}) = \infty.0$

$\lim\limits_{x\to\infty} \frac{\text{sen}\left(\frac{1}{x}\right)}{\frac{1}{x}} = \lim\limits_{t\to 0} \frac{\text{sen}\,t}{t} = 1$ **à** Fazendo $t = \frac{1}{x}$ $\begin{cases} x \to +\infty \\ t \to 0 \end{cases}$

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23. $\lim\limits_{x\to p/6}\dfrac{2.\text{sen}^2 x+\text{sen}\,x-1}{2.\text{sen}^2 x-3.\text{sen}\,x+1}=?$ **à** $\lim\limits_{x\to p/6}\dfrac{2.\text{sen}^2 x+\text{sen}\,x-1}{2.\text{sen}^2 x-3.\text{sen}\,x+1}=\lim\limits_{x\to p/6}\dfrac{1+\text{sen}\,x}{-1+\text{sen}\,x}=\dfrac{1+\text{sen}\,\frac{p}{6}}{-1+\text{sen}\,\frac{p}{6}}=$

$\dfrac{1+\frac{1}{2}}{-1+\frac{1}{2}}=-3$ **à** $f(x)=\dfrac{2.\text{sen}^2 x+\text{sen}\,x-1}{2.\text{sen}^2 x-3.\text{sen}\,x+1}=\dfrac{\left(\text{sen}\,x-\frac{1}{2}\right).(\text{sen}\,x+1)}{\left(\text{sen}\,x-\frac{1}{2}\right).(\text{sen}\,x-1)}=\dfrac{(\text{sen}\,x+1)}{(\text{sen}\,x-1)}=\dfrac{1+\text{sen}\,x}{-1+\text{sen}\,x}$

24. $\lim\limits_{x\to 1}(1-x).tg\left(\dfrac{px}{2}\right)=?$ **à** $\lim\limits_{x\to 1}(1-x).tg\left(\dfrac{px}{2}\right)=0.\infty$ **à** $f(x)=(1-x).tg\left(\dfrac{px}{2}\right)=$

$(1-x).\cot g\left(\dfrac{p}{2}-\dfrac{px}{2}\right)=\dfrac{(1-x)}{tg\left(\frac{p}{2}-\frac{px}{2}\right)}=\dfrac{\frac{p}{2}.(1-x).\frac{2}{p}}{tg\left(\frac{p}{2}-\frac{px}{2}\right)}=\dfrac{\frac{2}{p}}{\dfrac{tg\left(\frac{p}{2}-\frac{px}{2}\right)}{\frac{p}{2}.(1-x)}}=\dfrac{\frac{2}{p}}{\dfrac{tg\left(\frac{p}{2}-\frac{px}{2}\right)}{\left(\frac{p}{2}-\frac{px}{2}\right)}}$ **à**

$\lim\limits_{x\to 1}(1-x).tg\left(\dfrac{px}{2}\right)=\lim\limits_{x\to 1}\dfrac{\frac{2}{p}}{\dfrac{tg\left(\frac{p}{2}-\frac{px}{2}\right)}{\left(\frac{p}{2}-\frac{px}{2}\right)}}=\dfrac{\frac{2}{p}}{\lim\limits_{t\to 0}\frac{tg(t)}{t}}=\dfrac{2}{p}$ Fazendo uma mudança de variável,

temos : $t=\dfrac{p}{2}-\dfrac{px}{x}\begin{cases}x\to 1\\ t\to 0\end{cases}$

25. $\lim\limits_{x\to 1}\dfrac{1-x^2}{\text{sen}(px)}=?$ **à** $\lim\limits_{x\to 1}\dfrac{1-x^2}{\text{sen}(px)}=\lim\limits_{x\to 1}\dfrac{1+x}{\dfrac{p.\text{sen}(p-px)}{(p-px)}}=\dfrac{2}{p}$

$f(x)=\dfrac{1-x^2}{\text{sen}\,px}=\dfrac{(1-x).(1+x)}{\text{sen}(p-px)}=\dfrac{1+x}{\dfrac{\text{sen}(p-px)}{(1-x)}}=\dfrac{1+x}{\dfrac{p.\text{sen}(p-px)}{p.(1-x)}}=\dfrac{1+x}{\dfrac{p.\text{sen}(p-px)}{(p-px)}}$

26. $\lim\limits_{x\to 0}\cot g2x.\cot g\left(\dfrac{p}{2}-x\right)=?$ **à** $\lim\limits_{x\to 0}\cot g2x.\cot g\left(\dfrac{p}{2}-x\right)=\infty.0$

$f(x)=\cot g2x.\cot g\left(\dfrac{p}{2}-x\right)=\cot g2x.tgx=\dfrac{tgx}{tg2x}=\dfrac{tgx}{\dfrac{2tgx}{1-tg^2x}}=tgx.\dfrac{1-tg^2x}{2.tgx}=\dfrac{1-tg^2x}{2}$

$\lim\limits_{x\to 0}\cot g2x.\cot g\left(\dfrac{p}{2}-x\right)=\lim\limits_{x\to 0}\dfrac{1-tg^2x}{2}=\dfrac{1}{2}$

27. $\lim\limits_{x\to 0}\dfrac{\sqrt{\cos x}-\sqrt[3]{\cos x}}{\text{sen}^2 x}=\lim\limits_{t\to 1}\dfrac{-t^2}{1+t+t^2+\ldots+t^{10}+t^{11}}=-\dfrac{1}{12}$

$f(x)=\dfrac{\sqrt{\cos x}-\sqrt[3]{\cos x}}{\text{sen}^2 x}=\dfrac{t^3-t^2}{1-t^{12}}=\dfrac{-t^2.(1-t)}{(1-t).(1+t+t^2+\ldots+t^{10}+t^{11})}=\dfrac{-t^2}{1+t+t^2+\ldots+t^{10}+t^{11}}$

$t=\sqrt[2.3]{\cos x}=\sqrt[6]{\cos x}$ $\begin{cases}x\to 0\\ t\to 1\end{cases}$ $t^6=\cos x$, $t^{12}=\cos^2 x$, $\text{sen}^2 x=1-t^{12}$

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BriotxRuffini :

	1	0	0	...	0	-1
1	•	1	1	...	1	1
	1	1	1	...	1	***0***

28. $\lim\limits_{x\to p/4}\dfrac{\operatorname{sen}2x-\cos 2x-1}{\cos x-\operatorname{sen}x}=?$ **à** $\lim\limits_{x\to p/4}\dfrac{\operatorname{sen}2x-\cos 2x-1}{\cos x-\operatorname{sen}x}=\lim\limits_{x\to p/4}(-2.\cos x)=-2.\cos\dfrac{p}{4}=-2.\dfrac{\sqrt{2}}{2}=$
$-\sqrt{2}$

$$f(x)=\frac{\operatorname{sen}2x-\cos 2x-1}{\cos x-\operatorname{sen}x}=\frac{2.\operatorname{sen}x\cos x-\left(2\cos^2 x-1\right)-1}{\cos x-\operatorname{sen}x}=\frac{2.\operatorname{sen}x.\cos x-2\cos^2 x+1-1}{\cos x-\operatorname{sen}x}=$$

$$\frac{2.\operatorname{sen}x.\cos x-2\cos^2 x}{\cos x-\operatorname{sen}x}=\frac{-2.\cos x.(\cos x-\operatorname{sen}x)}{\cos x-\operatorname{sen}x}=-2.\cos x$$

29. $\lim\limits_{x\to 1}\dfrac{\operatorname{sen}(x-1)}{\sqrt{2x-1}-1}=?$ **à** $\lim\limits_{x\to 1}\dfrac{\operatorname{sen}(x-1)}{\sqrt{2x-1}-1}=\lim\limits_{x\to 1}\dfrac{1}{2}.\dfrac{\operatorname{sen}(x-1)}{(x-1)}.\dfrac{\sqrt{2x-1}+1}{1}=1$

$$f(x)=\frac{\operatorname{sen}(x-1)}{\sqrt{2x-1}-1}=\frac{\operatorname{sen}(x-1)}{\sqrt{2x-1}-1}.\frac{\sqrt{2x-1}+1}{\sqrt{2x-1}+1}=\frac{\operatorname{sen}(x-1)}{2x-1-1}.\frac{\sqrt{2x-1}+1}{1}=\frac{\operatorname{sen}(x-1)}{2.(x-1)}.\frac{\sqrt{2x-1}+1}{1}=$$

$$\frac{1}{2}.\frac{\operatorname{sen}(x-1)}{(x-1)}.\frac{\sqrt{2x-1}+1}{1}$$

30. $\lim\limits_{x\to\frac{p}{3}}\dfrac{1-2.\cos x}{x-\frac{p}{3}}=?$ **à** $\lim\limits_{x\to\frac{p}{3}}\dfrac{1-2.\cos x}{x-\frac{p}{3}}=\lim\limits_{x\to p/3}2.\operatorname{sen}\left(\dfrac{p/3+x}{2}\right).\dfrac{\operatorname{sen}\left(\dfrac{p/3-x}{2}\right)}{\left(\dfrac{p/3-x}{2}\right)}=$

$$2.\operatorname{sen}\left(\frac{p/3+p/3}{2}\right)=2.\operatorname{sen}\left(\frac{2p/3}{2}\right)=2.\operatorname{sen}\left(\frac{p}{3}\right)=2.\frac{\sqrt{3}}{2}=\sqrt{3}$$

$$f(x)=\frac{1-2.\cos x}{x-\frac{p}{3}}=\frac{2.\left(\frac{1}{2}-\cos x\right)}{x-\frac{p}{3}}=\frac{2.\left(\cos\frac{p}{3}-\cos x\right)}{x-\frac{p}{3}}=\frac{2.(-2)\operatorname{sen}\left(\frac{p/3+x}{2}\right).\operatorname{sen}\left(\frac{p/3-x}{2}\right)}{-1.2.\left(\frac{p/3-x}{2}\right)}=$$

$$\frac{2.\operatorname{sen}\left(\frac{p/3+x}{2}\right).\operatorname{sen}\left(\frac{p/3-x}{2}\right)}{\left(\frac{p/3-x}{2}\right)}=2.\operatorname{sen}\left(\frac{p/3+x}{2}\right).\frac{\operatorname{sen}\left(\frac{p/3-x}{2}\right)}{\left(\frac{p/3-x}{2}\right)}$$

31. $\lim\limits_{x\to 0}\dfrac{1-\cos 2x}{x.\operatorname{sen}x}=?$ **à** $\lim\limits_{x\to 0}\dfrac{1-\cos 2x}{x.\operatorname{sen}x}=\lim\limits_{x\to\frac{p}{3}}\dfrac{2.\operatorname{sen}x}{x}=2$

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Sete páginas e 34 limites resolvidos

$$f(x)=\frac{1-\cos 2x}{x.\operatorname{sen} x}=\frac{1-\left(1-2\operatorname{sen}^2 x\right)}{x.\operatorname{sen} x}=\frac{1-1+2\operatorname{sen}^2 x}{x.\operatorname{sen} x}=\frac{2.\operatorname{sen}^2 x}{x.\operatorname{sen} x}=\frac{2.\operatorname{sen} x}{x}$$

32. $\lim\limits_{x\to 0}\dfrac{x}{\sqrt{1+\operatorname{sen} x}-\sqrt{1-\operatorname{sen} x}}=?$ **à** $\lim\limits_{x\to 0}\dfrac{x}{\sqrt{1+\operatorname{sen} x}-\sqrt{1-\operatorname{sen} x}}=\lim\limits_{x\to 0}\dfrac{\sqrt{1+\operatorname{sen} x}+\sqrt{1-\operatorname{sen} x}}{\dfrac{2.\operatorname{sen} x}{x}}=\dfrac{1+1}{2.1}$

=1

$$f(x)=\frac{x}{\sqrt{1+\operatorname{sen} x}-\sqrt{1-\operatorname{sen} x}}=\frac{x.\left(\sqrt{1+\operatorname{sen} x}+\sqrt{1-\operatorname{sen} x}\right)}{1+\operatorname{sen} x-(1-\operatorname{sen} x)}=\frac{x.\left(\sqrt{1+\operatorname{sen} x}+\sqrt{1-\operatorname{sen} x}\right)}{1+\operatorname{sen} x-1+\operatorname{sen} x}=$$

$$\frac{x.\left(\sqrt{1+\operatorname{sen} x}+\sqrt{1-\operatorname{sen} x}\right)}{2.\operatorname{sen} x}=\frac{\sqrt{1+\operatorname{sen} x}+\sqrt{1-\operatorname{sen} x}}{2.\dfrac{\operatorname{sen} x}{x}}=\frac{1+1}{2.1}=1$$

33. $\lim\limits_{x\to 0}\dfrac{\cos 2x}{\cos x-\operatorname{sen} x}=\lim\limits_{x\to 0}\dfrac{\cos x+\operatorname{sen} x}{1}=\dfrac{\sqrt{2}}{2}+\dfrac{\sqrt{2}}{2}=\sqrt{2}$

$$f(x)=\frac{\cos 2x}{\cos x-\operatorname{sen} x}=\frac{\cos 2x.(\cos x+\operatorname{sen} x)}{(\cos x-\operatorname{sen} x).(\cos x+\operatorname{sen} x)}=\frac{\cos 2x.(\cos x+\operatorname{sen} x)}{\cos^2 x-\operatorname{sen}^2 x}=\frac{\cos 2x.(\cos x+\operatorname{sen} x)}{\cos 2x}=$$

$$\frac{\cos 2x.(\cos x+\operatorname{sen} x)}{\cos 2x}=\frac{\cos x+\operatorname{sen} x}{1}=\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}=\sqrt{2}$$

34. $\lim\limits_{x\to\frac{p}{3}}\dfrac{\sqrt{3}-2.\operatorname{sen} x}{x-\dfrac{p}{3}}=?$ **à** $\lim\limits_{x\to\frac{p}{3}}\dfrac{\sqrt{3}-2.\operatorname{sen} x}{x-\dfrac{p}{3}}=\lim\limits_{x\to\frac{p}{3}}\dfrac{2.\left(\dfrac{\sqrt{3}}{2}-\operatorname{sen} x\right)}{x-\dfrac{p}{3}}=\lim\limits_{x\to\frac{p}{3}}\dfrac{2.\left(\operatorname{sen}\dfrac{p}{3}-\operatorname{sen} x\right)}{x-\dfrac{p}{3}}=$

$$\lim_{x\to\frac{p}{3}}\frac{2.\left(\operatorname{sen}\left(\dfrac{\frac{p}{3}-x}{2}\right).\cos\left(\dfrac{\frac{p}{3}+x}{2}\right)\right)}{x-\dfrac{p}{3}}=\lim_{x\to\frac{p}{3}}\frac{2.\left(\operatorname{sen}\left(\dfrac{\frac{p-3x}{3}}{2}\right).\cos\left(\dfrac{\frac{p+3x}{3}}{2}\right)\right)}{\dfrac{3x-p}{3}}=$$

$$\lim_{x\to\frac{p}{3}}\frac{2.\left(\operatorname{sen}\left(\dfrac{p-3x}{6}\right).\cos\left(\dfrac{p+3x}{6}\right)\right)}{\dfrac{-1.(p-3x)}{3}}$$

35. ?