142

$$\lim_{x\to 1} \frac{e^{-x}+2\,\mathrm{sen}(x-1)}{\sqrt[5]{2+\cos\pi x}-1}\log^2(1+\mathrm{sen}\,\pi x) =$$

$$= \lim_{x\to 1} \frac{e^{-x}+2\,\mathrm{sen}(x-1)}{\sqrt[5]{2+\cos\pi x}-1}\frac{(1+\mathrm{sen}\,\pi x)^2\log^2(1+\mathrm{sen}\,\pi x)}{(1+\mathrm{sen}\,\pi x)^2} \to 1$$

$$= \lim_{x\to 1} \frac{e^{-x}+2\,\mathrm{sen}(x-1)}{\sqrt[5]{2+\cos\pi x}-1}\,\mathrm{sen}^2\pi x \cdot \underbrace{\frac{\log^2(1+\mathrm{sen}\,\pi x)}{\mathrm{sen}^2\pi x}}_{\to 1}$$

per $x\to 1$ $\mathrm{sen}\,\pi x \to 0$ quindi è il limite $\lim_{y\to 0}\frac{\log(1+y)}{y}=1$

$$= \lim_{x\to 1} \underbrace{\left[e^{-x}+2\,\mathrm{sen}(x-1)\right]}_{\downarrow\ \frac{1}{e}} \cdot \frac{\mathrm{sen}^2\pi x}{1+\cos\pi x}\,\frac{1+\cos\pi x}{[1+(1+\cos\pi x)]^{1/5}-1} =$$

$$\to \frac{1}{\frac{1}{5}}$$

$$= \cancel{\lim_{x\to 1}}\ \cancel{\frac{1/e}{5e}}\ \frac{5}{e}\lim_{x\to 1}\frac{1-\cos^2\pi x}{1+\cos\pi x} =$$

$$= \frac{5}{e}\lim_{x\to 1}\frac{\cancel{(1+\cos\pi x)}(1-\cos\pi x)}{\cancel{1+\cos\pi x}} = \frac{5}{e}(1-(-1)) = \frac{10}{e}$$