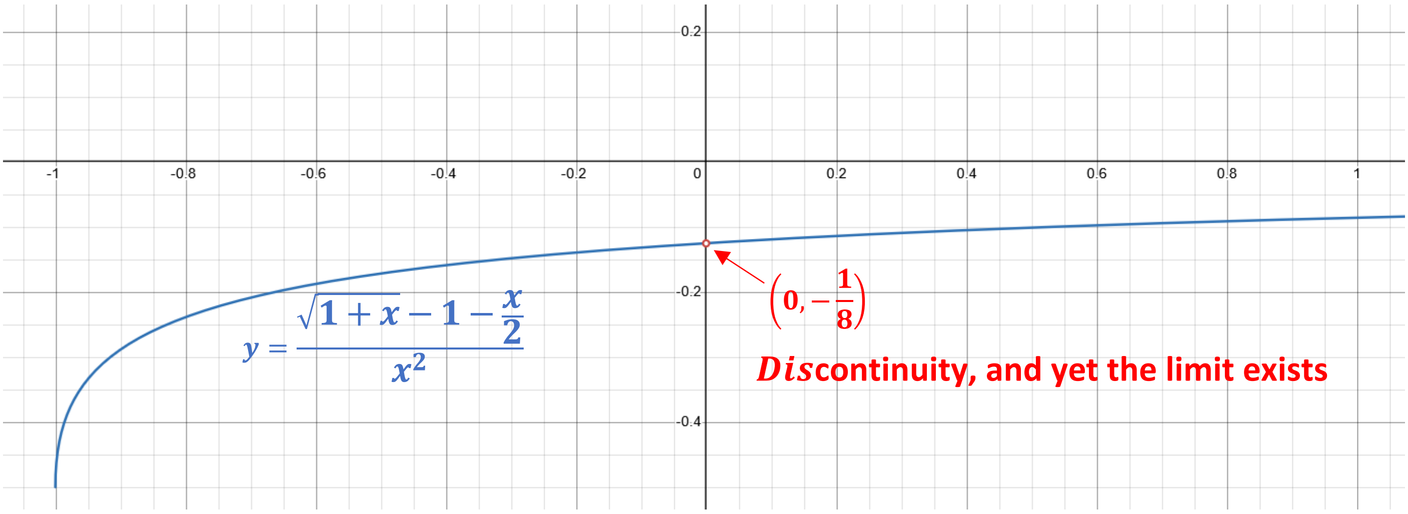
$$\lim_{x\to 0}\frac{\sqrt{1+x}-1-\frac{x}{2}}{x^2}=\left[\frac{0}{0}\right]=?$$

$$=\lim_{x\to 0}\frac{\left[\sqrt{1+x}-\left(1+\frac{x}{2}\right)\right]\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}{x^2\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=\lim_{x\to 0}\frac{1+x-\left(1+\frac{x}{2}\right)^2}{x^2\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=$$

$$=\lim_{x\to 0}\frac{1+x-\left(1+x+\frac{x^2}{4}\right)}{x^2\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=\lim_{x\to 0}\frac{-\frac{x^2}{4}}{x^2\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=$$

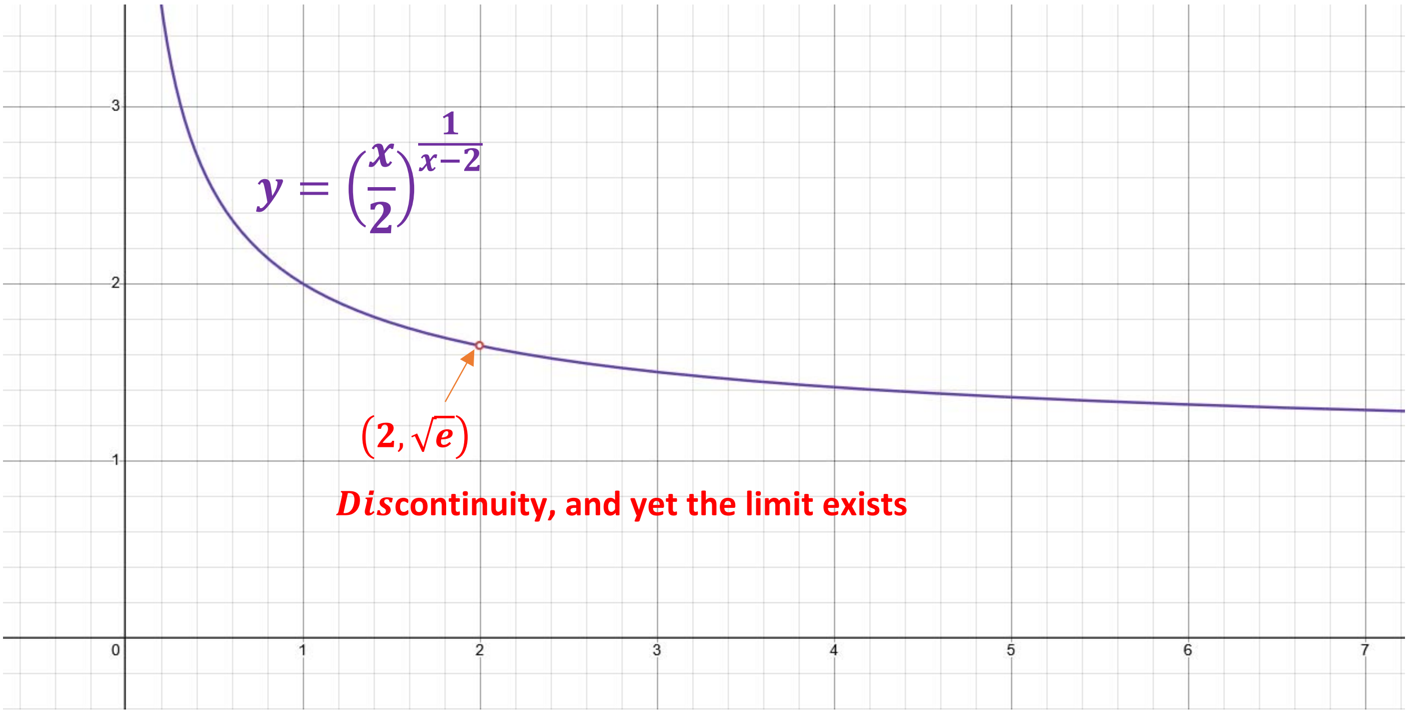
$$=-\lim_{x\to 0}\frac{x^2}{4x^2\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=-\frac{1}{4}\lim_{x\to 0}\frac{1}{\left[\sqrt{1+x}+\left(1+\frac{x}{2}\right)\right]}=-\frac{1}{4}\cdot\frac{1}{2}=-\frac{1}{8}$$



$$\lim_{x\to 2}\left(\frac{x}{2}\right)^{\frac{1}{x-2}} = [1^{\infty}] \quad => \quad Euler$$

$$= \lim_{x\to 2}\left(1+\frac{x}{2}-1\right)^{\frac{1}{x-2}} = \lim_{x\to 2}\left(1+\frac{x-2}{2}\right)^{\frac{1}{x-2}} = \lim_{x\to 2}\left(1+\frac{x-2}{2}\right)^{\frac{2}{x-2}\cdot\frac{1}{2}} =$$

$$= \lim_{x\to 2}\left[\left(1+\frac{x-2}{2}\right)^{\frac{2}{x-2}}\right]^{\frac{1}{2}} = \lim_{\varepsilon\to 0}\left[(1+\varepsilon)^{\frac{1}{\varepsilon}}\right]^{\lim_{\varepsilon\to 0}\frac{1}{2}} = e^{\frac{1}{2}} = \sqrt{e}$$



$$\lim_{x\to\infty}\left(\frac{x+1}{x+2}\right)^{2x} = [1^\infty] \;\; => \;\; Euler$$

$$\lim_{x\to\infty}\left(\frac{x+1}{x+2}\right)^{2x} = \lim_{x\to\infty}\left(\frac{x+2-1}{x+2}\right)^{2x} = \lim_{x\to\infty}\left(1+\frac{-1}{x+2}\right)^{2x} = \lim_{x\to\infty}\left[\left(1+\frac{-1}{x+2}\right)^{\frac{x+2}{-1}\cdot\frac{-1}{x+2}}\right]^{2x} =$$

$$= \lim_{x\to\infty}\left[\left(1+\frac{-1}{x+2}\right)^{\frac{x+2}{-1}}\right]^{\frac{-1}{x+2}\cdot 2x} = \lim_{x\to\infty}\left[\left(1+\frac{-1}{x+2}\right)^{\frac{x+2}{-1}}\right]^{\cdot\frac{-2x}{x+2}} =$$

$$= \lim_{x\to\infty}\left[\left(1+\frac{-1}{x+2}\right)^{\frac{x+2}{-1}}\right]^{-2\cdot\lim\limits_{x\to\infty}\frac{x}{x+2}} = \lim_{\varepsilon\to 0}\left[(1+\varepsilon)^{\frac{1}{\varepsilon}}\right]^{-2\cdot\lim\limits_{x\to\infty}\frac{1}{1+2/x}} = e^{-2\cdot 1} = \frac{1}{e^2}$$