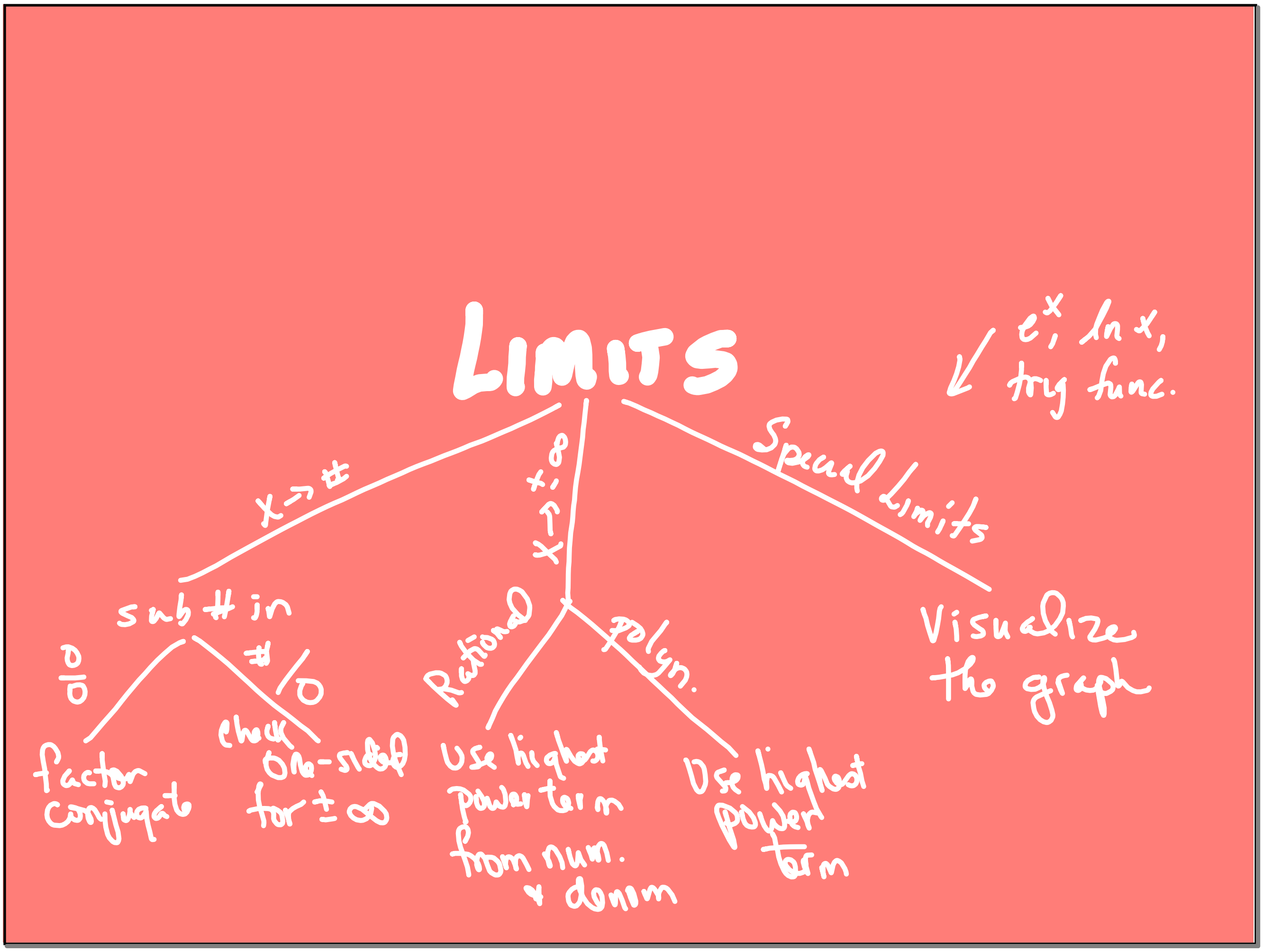
September 6, 2023



Special Limits

$$\lim_{x\to 0} \frac{\sin(nx)}{nx} = 1.$$

$$\lim_{x\to 0} \frac{1-\cos(nx)}{nx} = 0$$

$$\lim_{x\to 0} \frac{\sin(5x)}{10x}$$

$$\frac{1}{2} \lim_{x\to 0} \frac{\sin(5x)}{5x}$$

$$= \frac{1}{2} \cdot 1$$

$$= 1/2$$

$$\lim_{x\to 0} \frac{3(1-\cos(12x))}{3\cdot 4x}$$

$$3 \lim_{x\to 0} \frac{1-\cos(12x)+1}{12x}$$

$$= 3\cdot 0$$

$$= 0$$

$$\lim \frac{(1-\cos 12x)}{12x} + \lim_{x\to 0} \frac{1}{12x}$$

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$$\lim_{x\to 0} \frac{\frac{1}{x}\sin 2x}{\frac{1}{x}\sin 16x}$$

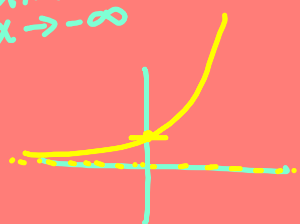
$$\lim_{x\to 0} \frac{\frac{2\cdot\sin 2x}{2\cdot x}}{\frac{16\cdot\sin 16x}{16\cdot x}}$$

$$\frac{2}{16}\lim_{x\to 0} \frac{\frac{\sin 2x}{2x}}{\frac{\sin 16x}{16x}}$$

$$\frac{1}{8}\cdot\frac{1}{1} = \frac{1}{8}$$

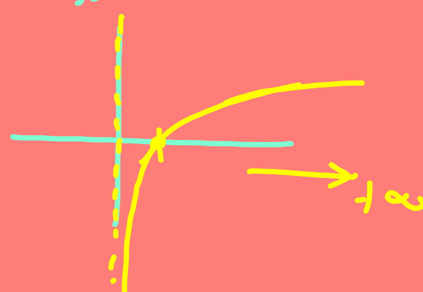
$$\lim_{x \to \infty} e^x = +\infty$$

$$\lim_{x \to -\infty} e^x = 0$$



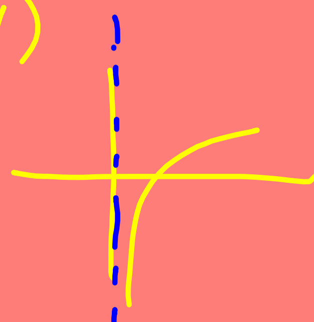
$$\lim_{x \to \infty} \ln x = +\infty$$

$$\lim_{x \to 0^+} \ln x = -\infty$$



$$\lim_{x \to -\infty} \frac{1-e^x}{e^{-x}} = \frac{1-e^{-\infty}}{e^{\infty}} = \frac{1-0}{\infty} = \frac{1}{\infty} = 0$$

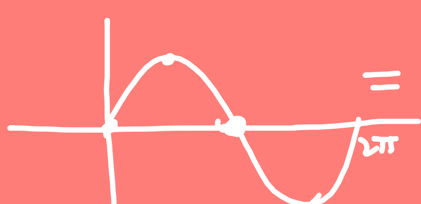
$$\lim_{x\to \frac{\pi}{4}^+} \ln(1-\tan x)$$
$$= \ln\left(1-\tan\tfrac{\pi}{4}\right)$$
$$= \ln(1-1)$$
$$= \ln 0$$
$$= -\infty$$



$$\lim_{x\to\pi^+} \sec x = \sec \pi$$
$$= -1$$

$$\lim_{x\to \frac{\pi}{2}^-} \sec x = \sec\frac{\pi}{2}$$
$$= \frac{1}{0}$$
$$= +\infty$$

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



$$= \frac{\pi/3}{0^+} = \frac{+}{-}$$

$$= -\infty$$