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Suppose that $\lim_{n \rightarrow \infty} \frac{F_n}{F_{n-1}}$ exists.

Start with the Fibonacci recurrence:

$$F_n = F_{n-1} + F_{n-2}$$

Divide by F_{n-1} :

$$\frac{F_n}{F_{n-1}} = \frac{F_{n-1}}{F_{n-1}} + \frac{F_{n-2}}{F_{n-1}}$$

$$\text{Let } X = \lim_{n \rightarrow \infty} \frac{F_n}{F_{n-1}} = \lim_{n \rightarrow \infty} \frac{F_{n-1}}{F_{n-2}}$$

