

ES: what happens when we find the limit as $x \rightarrow \infty$?

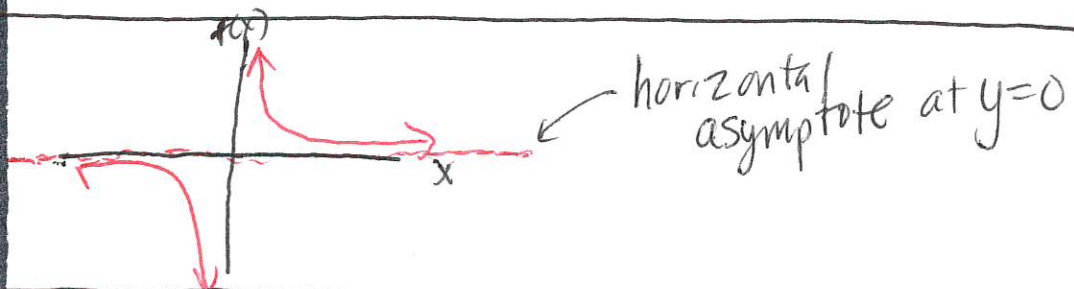
(ex)

Find $\lim_{x \rightarrow \infty} \frac{1}{x}$ table

x	$f(x)$
1	1
10	0.10
1000	0.001
1,000,000	0.000001
∞	0

$$\lim_{x \rightarrow \infty} \frac{1}{x} = \boxed{0}$$

$$\lim_{x \rightarrow -\infty} \frac{1}{x} = \boxed{0}$$

GraphAnalytically

$$\lim_{x \rightarrow \infty} \frac{3x^5 - 10x}{2x^5 + 4} = \lim_{x \rightarrow \infty} \frac{3x^5}{2x^5} = \lim_{x \rightarrow \infty} \frac{3}{2} = \boxed{\frac{3}{2}}$$

①

Degree of
num. is
the same as
den.

② Degree of Num. is less than the den.

$$\lim_{x \rightarrow \infty} \frac{3x^3 + 2x^2}{6x^4 - x} = \lim_{x \rightarrow \infty} \frac{3x^3}{6x^4} = \lim_{x \rightarrow \infty} \frac{1}{2x} = \frac{1}{2 \cdot \infty} = \frac{1}{\infty} = \boxed{0}$$

③ Degree of Num. is greater than the den.

$$\lim_{x \rightarrow \infty} \frac{4x^4 - 5}{2x^3 + x^2} = \lim_{x \rightarrow \infty} \frac{4x^4}{2x^3} = \lim_{x \rightarrow \infty} 2x = 2 \cdot \infty = \boxed{\infty}$$

Indeterminate Forms

$$\left. \begin{array}{l} \frac{\infty}{\infty} = \text{Indeterminate} \\ \frac{0}{0} = \text{Indeterminate} \\ 0 \cdot \infty = \text{Indeterminate} \end{array} \right\} \text{Cannot determine their limit}$$

Continuity

Find the constant **a** such that the function is continuous.

$$f(x) = \begin{cases} x+1, & x \leq 2 \\ ax-1, & x > 2 \end{cases}$$

to be continuous

$$\begin{aligned} x+1 &= ax-1 \\ (2)+1 &= a(2)-1 \\ 3 &= 2a-1 \\ 4 &= 2a \end{aligned}$$

$$\rightarrow \boxed{a=2}$$

Summary