Asymptotic Notations using Limits





 $f = \Theta(g)$ f grows at the same rate as g There exists an n_0 and constants $c_1, c_2 > 0$ such that for all $n > n_0$, $c_1g(n) \le |f(n)| \le c_2g(n)$.

f = O(g) f grows no faster than g There exists an n_0 and a constant c > 0 such that for all $n > n_0$, $|f(n)| \le cg(n)$.

 $f = \Omega(g)$ f grows at least as fast as g There exists an n_0 and a constant c > 0 such that for all $n > n_0$, $cg(n) \le |f(n)|$.

 $\lim_{n\to\infty} f(n)/g(n) \neq 0, \infty \Rightarrow f = \Theta(g)$ $\lim_{n\to\infty} f(n)/g(n) \neq \infty \Rightarrow f = O(g)$ $\lim_{n\to\infty} f(n)/g(n) \neq 0 \Rightarrow f = O(g)$

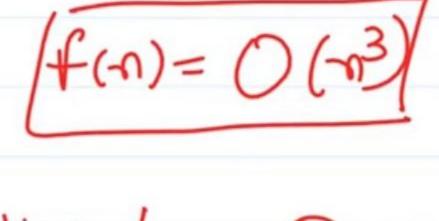




$$f(n) = 1$$

$$g(n) = 2$$

$$\lim_{n \to \infty} \frac{n^2}{n}$$



$$f(n) = n^3$$

$$g(n) = n^2 \lim_{n \to \infty} \frac{n^3}{n^2} = \infty$$

$$f(n) = 2 (g(n))$$

$$\lim_{n \to \infty} (5 + 6n + 7) = 5 + 0n$$

$$\lim_{n \to \infty} (5 + 6n + 7) = 5 + 0n$$

$$\int_{-\infty}^{\infty} f(n) = 0 (n^{2})$$

6n+7