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$f(n) = n - 100$ $\quad$ $g(n) = n - 200$

$$\lim_{n \to \infty} \frac{n - 100}{n - 200} = \frac{n}{n} = 1 \quad \therefore \quad f(n) = O(g(n)) \;\Big|\; f(n) = \Omega(g(n)) \;\Big|\; f(n) = \Theta(g(n))$$

$f(n) = \log n$ $\quad$ $g(n) = (\log n)^2$

$$\lim_{n \to \infty} \frac{\log n}{(\log n)^2} = \frac{\log n}{\log n \, \log n} = \frac{1}{\log n} = 0 \quad \therefore \quad f(n) = o(g(n))$$

$$f(n) = O(g(n)$$

$f(n) = \log n$ $\quad$ $g(n) = \log n^2$

$$\lim_{n \to \infty} \frac{\log n}{\log n^2} = \frac{\log n}{2 \log n} = \frac{1}{2} \quad \therefore \quad f(n) = O(g(n)) \;\Big|\; f(n) = \Omega(g(n)) \;\Big|\; f(n) = \Theta(g(n))$$

$f(n) = 2^n$ $\quad$ $g(n) = 2^{n+1}$

$$\lim_{n \to \infty} \frac{2^n}{2^{n+1}} = \frac{2^n}{2^n \cdot 2} = \frac{1}{2} \quad \therefore \quad f(n) = O(g(n)) \;\Big|\; f(n) = \Omega(g(n)) \;\Big|\; f(n) = \Theta(g(n))$$

$f(n) = n!$ $\quad$ $g(n) = 2^n$

$$\lim_{n \to \infty} \frac{n!}{2^n} = \infty \quad \therefore \quad f(n) = \omega(g(n)) \;\Big|\; f(n) = \Omega(g(n))$$

$f(n) = 2n^2 + 5n$ $\quad$ $g(n) = n^2$

$$\lim_{n \to \infty} \frac{2n^2 + 5n}{n^2} \cdot \frac{1/n^2}{1/n^2}$$

$$\lim_{n \to \infty} \frac{\frac{2n^2}{n^2} + \frac{5n}{n^2}}{n^2/n^2}$$

$$\lim_{n \to \infty} \frac{2 + 5/n}{1} = 2 \quad \therefore \quad f(n) = O(g(n)) \;\Big|\; f(n) = \Omega(g(n)) \;\Big|\; f(n) = \Theta(g(n))$$

$f(n) = 2n^2 + 5n$ $g(n) = n^3$

$$\lim_{n \to \infty} \frac{2n^2 + 5n}{n^3} \cdot \frac{1/n^3}{1/n^3}$$

$$\lim_{n \to \infty} \frac{\frac{2n^2}{n^3} + \frac{5n}{n^3}}{n^3/n^3}$$

$$\lim_{n \to \infty} \frac{\frac{2}{n} + \frac{5}{n^2}}{1}$$

$$\lim_{n \to \infty} 0$$

$\therefore \quad f(n) = o(g(n)) \mid f(n) = O(g(n))$