

$$\textcircled{1} f(n) = n-10 \quad g(n) = n+10$$

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

Big O

$$\text{cond} \rightarrow f(n) \leq c \cdot g(n)$$

$$n-10 \leq c \cdot n+10$$

$$--- c = 1$$

$$n-10 \leq n+10$$

$$\boxed{f(n) = O(g(n))}$$

Omega

$$f(n) = \Omega(g(n))$$

$$f(n) \geq c \cdot g(n)$$

$$n-10 \geq c(n+10)$$

$$--- c = \frac{1}{2}$$

$$n-10 \geq \frac{n+10}{2}$$

$$\boxed{f(n) = \Omega(g(n))}$$

$$\textcircled{2} \left. \begin{array}{l} f(n) = n \\ f(n) = O(g(n)) \end{array} \right\} g(n) = n$$

Big O

$$f(n) \leq c \cdot g(n)$$

$$n \leq c \cdot n$$

$$--- c = 1$$

$$n \leq n$$

$$\boxed{f(n) = O(g(n))}$$

Omega

$$f(n) \geq c \cdot g(n)$$

$$n \geq c \cdot n$$

$$c = 1$$

$$n \geq n$$

$$\boxed{f(n) = \Omega(g(n))}$$

$$\textcircled{3} 64^{1092n} \cdot 32^{1092n} = O(n^5)$$

$$\text{LHS} = 64^{1092n} \cdot 32^{1092n}$$

using log property

$$= n^{1092 \cdot 64} \cdot n^{1092 \cdot 32}$$

$$= n^{1092 \cdot 2^6} \cdot n^{1092 \cdot 2^5}$$

$$= n^6 \cdot n^5 = n^{11}$$

$$\text{RHS} = n^5$$

$$\boxed{\text{LHS} \neq \text{RHS}}$$

$$\textcircled{4} \frac{4^n}{2^n} = O(2^n)$$

$$\text{LHS} = \frac{4^n}{2^n}$$

$$= \frac{2^n \times 2^n}{2^n}$$

$$= 2^n, \quad \text{RHS} = O(2^n)$$

$$\boxed{2^n \leq O(2^n)}$$

$$\boxed{\text{LHS} = \text{RHS}}$$

$$\textcircled{5} 128^{1092n} \cdot n^2 = O(n^9)$$

$$\text{LHS} = 128^{1092n}$$

using log property

$$= 2^{n \log_2 128}$$

$$= n^9 \quad \text{RHS} = O(n^9)$$

$$n^9 \geq c \cdot n^9$$

$$c = 1$$

$$\boxed{n^9 \geq n^9}$$

$$\boxed{\text{LHS} = \text{RHS}}$$