12. $f(n) = \sqrt{n}$, $g(n) = 5^{\log_2 n}$.

Solution: $g(n) = 5^{\log_2 n} = n^{\log_2 5}$

$$L = \lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim_{n\to\infty} \frac{n^{1/2}}{n^{\log_2 5}} = \lim \frac{n^{1/2}}{n^{2.25}} = \lim \frac{1}{n^{1.75}} = 0$$

$\therefore f(n) = o(g(n))$.

13. $f(n) = n2^n$; $g(n) = 3^n$.

Solution: $L = \lim_{n\to\infty} \frac{f(n)}{g(n)} = \lim \frac{n2^n}{3^n}$

$$= \lim n\left(\frac{2}{3}\right)^n = \lim \frac{n}{\left(\frac{3}{2}\right)^n}$$

$$= \lim \frac{n}{1.5^n} = 0$$

$$\boxed{\begin{array}{l} a^n \gg n \gg \log n \\ a > 1,\ as\ n \to \infty \\ \text{important for exam.} \end{array}}$$

$\therefore f(n) = o(g(n))$

15. $f(n) = (\log n)^{\log n}$; $g(n) = 2^{(\log_2 n)^2}$

SOLUTION: $g(n) = 2^{(\log_2 n)^2} = 2^{(\log_2 n)(\log_2 n)}$
$= n^{(\log_2 2)\log_2 n} = n^{\log_2 n}$

$$L = \lim \frac{f(n)}{g(n)} = \lim \frac{(\log n)^{\log n}}{n^{\log_2 n}} = \lim \left(\frac{\log n}{n}\right)^{\log n}$$

$= 0$

$\therefore f(n) = o(g(n))$