M2 Standard 12

$f(n) = (\ln n)^2$, $g(n) = 5n^3$

$$\lim_{n\to\infty} \frac{(\ln n)^2}{5n^3} = \frac{\infty}{\infty} = \text{indeterminate}$$

$$\lim_{n\to\infty} \frac{2(\ln n)\left(\frac{1}{n}\right)}{15n^2} = \frac{\infty}{\infty} = \text{indeterminate}$$

$$\lim_{n\to\infty} \frac{2(\ln n)}{15n^3}$$

$$\lim_{n\to\infty} \frac{\frac{2}{n}}{45n^2}$$

$$\lim_{n\to\infty} \frac{2}{45n^3} = \frac{2}{\infty} = 0$$

From the above we can see that $g(n)$ will grow faster than $f(n)$, such that:

$$f(n) \in O(g(n))$$

$g(n)$ will grow faster than $f(n)$.