$$\lim_{n\to\infty} \frac{5n^3}{9n} = \infty \quad \text{not} < \infty$$

so ~~$f \in$~~ $g \in O(f)$ does not hold

$$\lim_{n\to\infty} \frac{5n^3}{9n} = \infty \neq 0$$

so $g \in o(f)$ does not hold

$$\lim_{n\to\infty} \frac{5n^3}{9n} = \infty \text{ which is } \geq 0.$$

so $g \in \Omega(f)$ holds.

$$\lim_{n\to\infty} \frac{5n^3}{9n} = \infty$$

so $g \in \omega(f)$ holds.

b) $f(n) = 9n^{0.8} + 2n^{0.5} + 14\log n$, $g(n) = \sqrt{n}$

$$\lim_{n\to\infty} \frac{f(n)}{g(n)}$$

$$\lim_{n\to\infty} \frac{9n^{0.8} + 2n^{0.5} + 14\log n}{\sqrt{n}}$$

$$= \infty$$

$f \in \Omega(g)$ holds.

so $f \in \Theta(g)$ does not hold

$f \in \omega(g)$ holds.

$\sqrt{n^8}$

$f \in O(g)$ ~~does not hold~~ does not hold

$f \in o(g)$ does not hold