for $f(n) = o(g(n))$

$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = 0$$

i. $(1/3)^n + 17$

, 1 term gets smaller as $n \to \infty$

but term 17 remains constant

$\&$ $17 > (1/3)^n$

ii) $$\lim_{n \to \infty} \frac{17}{\log \log n} = 0$$

iii) $$\lim_{n \to \infty} \frac{\log \log n}{\log n}$$ let $\log n = y$

l'Hopital's rule

$$\lim_{y \to \infty} \frac{\log y}{y} = \lim_{y \to \infty} \frac{1}{y} = 0$$

iv) $$\lim_{n \to \infty} \frac{\log n}{2^{\sqrt{\log n}}}$$ let $\log n = y$

$$\lim_{y \to \infty} \frac{y}{2^{\sqrt{y}}}$$ l'Hopital's rule

$$\lim_{y \to \infty} \frac{1}{2^{\sqrt{y}} \cdot \frac{1}{2\sqrt{y}} \cdots} \cdots = 0$$

v) $$\lim_{n \to \infty} \frac{2^{\sqrt{\log n}}}{\sqrt{n}}$$ let $\sqrt{\log n} = y$

$n = e^{2y}$

$$= \lim_{y \to \infty} \frac{2^y}{\sqrt{e^{2y}}} = \frac{2^y}{e^y} = 0$$

$e^y > 2^y$

vi)

$$\lim_{y \to \infty} \frac{\sqrt{n}}{\sqrt{n}\,\log n} = \lim_{y \to \infty} \frac{1}{\log n} = 0$$

$$\sqrt{n}\,\log n > \sqrt{n}$$

vii) $\lim_{n\to\infty} \dfrac{\sqrt{n}\log n}{\dfrac{n}{\log n}} = \lim_{n\to\infty} \dfrac{\sqrt{n}\cdot(\log n)^2}{n}$

let $\log n = y$

$n = e^y$

$= \lim_{y\to\infty} \dfrac{y^2}{e^{y/2}}$

l'Hopital's rule

$= \lim_{y\to\infty} \dfrac{2y \cdots}{\frac{1}{2}e^{y/2}\cdots} = 0$

$\therefore \dfrac{n}{\log n} > \sqrt{n}\log n$

viii) $\lim_{n\to\infty} \dfrac{n/\log n}{2n} = \lim_{n\to\infty} \dfrac{n}{\log n \times 2n} = \dfrac{1}{\log n} = 0$

$\therefore 2n > \dfrac{n}{\log n}$

ix) $\lim_{n\to\infty} \dfrac{2n}{(1.5)^n}$, l'Hopital's rule

$\lim_{n\to\infty} \dfrac{2}{n(1.5)^{n-1}} = 0$ $\quad\therefore (1.5)^n > 2n$

x) $\lim_{n\to\infty} \dfrac{(1.5)^n}{\left(\frac{n}{2}\right)^{\log n}}$

let $\log n = y$

$n = e^y$

$\lim_{y\to\infty} \dfrac{(1.5)^{e^y}}{\left(\frac{e^y}{2}\right)^y} = \lim_{y\to\infty} \dfrac{(1.5)^{e^y} \times 2^y}{e^{y^2}} \cdots = 0$

$(n/2)^{\log n} > (1.5)^n$