Task 1

Task 1

(b) $2^{2n} = O(2^n)$

$\lim_{n\to\infty} \frac{2^{2n}}{2^n} = 0$ or C

$\lim_{n\to\infty} \frac{(2^n)^2}{2^n} = 0$ or C

$\lim_{n\to\infty} 2^n \neq 0$ or C

Since as $\lim_{n\to\infty} 2^n = \infty$

$\therefore\ 2^{2n} \neq O(2^n)$

(a) lim $2^{n+1} = O(2^n)$

$\lim_{n\to\infty} \frac{2^{n+1}}{2^n} = 0$ or C

$\lim_{n\to\infty} 2 = C$

$\therefore\ 2^{n+1} = O(2^n)$

as required

Task 2

Task 2

(b) $\lim_{n\to\infty} \dfrac{n\lg(n)}{n\lg(n) - 15n + 14\sqrt{n}}$

$= \lim_{n\to\infty} \dfrac{1}{1 - \frac{15n}{n\lg n} + \frac{14\sqrt{n}}{n\lg n}}$

$= 1$

(a) $f(n) = \left(\frac{4}{9}\right)^0 + \left(\frac{4}{9}\right)^1 + \left(\frac{4}{9}\right)^2 + \left(\frac{4}{9}\right)^3 + \dots + \left(\frac{4}{9}\right)^n$

$r = \frac{4}{9}$

$\cancel{\sum_{k=0}^{n} \left(\frac{4}{9}\right)^k = \frac{\left(\frac{4}{9}\right)^{n+1} - 1}{\frac{4}{9} - 1}}$

$\sum_{k=0}^{n} \left(\frac{4}{9}\right)^k \le \sum_{n=0}^{\infty} \left(\frac{4}{9}\right)^k = \frac{1}{1 - \frac{4}{9}}$

$= \frac{1}{\frac{5}{9}}$

$f(n) = \frac{9}{5}$