Sam Lewis

1) $f(n) = 32n$

$g(n) = n$

$\lim_{n\to\infty} \frac{32n}{n} =$

$\lim_{n\to\infty} 32$

$\lim_{n\to\infty} 32$

Show that both grow at same rate

2) $f(n) = \ln(n)$ $g(n) = n$

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

grows towards 0, therefore

$\ln(n)\, \Omega(n)$ is not true

3) $f(n) = \lg(n)$ $g(n) = \ln(n)$

$$\lim_{n\to\infty} \frac{\lg(n)}{\ln(n)} \to \lim_{n\to\infty} \frac{\frac{\ln(n)}{\ln(2)}}{\ln n} \to \frac{1}{\ln(2)}$$

therefore it is true, grow at same rate

4) $f(n) = \log_c(n)$ $g(n) = \ln(n)$

$$\lim_{n\to\infty} \frac{\log_c(n)}{\ln(n)} \to \frac{\frac{\ln n}{\ln(c)}}{\ln(n)} \to \frac{1}{\ln(c)}$$

$\frac{1}{\ln(c)}$ when $c > 1$ is a constant, therefore statement is true.

5) $f(n) = n^2$ $\quad g(n) = 2^n$

$\lim_{n \to \infty} \frac{n^2}{2^n} \to \frac{n^2}{2^n} = 0$ when $\lim n \to \infty$

therefore statement is true.

6) $f(n) = n^3$ $\quad g(n) = n^2$

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

therefore statement is true

7) $f(n) = 4^{\log(n)}$ $\quad g(n) = n$

$4^{\log n} = 4^{\log_2 n} = 2^{2(\log_2)_2 n} = 2^{n^{2(\log_2)+1}}$

$= n^2$, $\lim_{n \to \infty} \frac{n^2}{n} =$ $\quad \lim(n \to \infty) n = \infty$ not a constant therefore not true.

8) $f(n) = \ln^2(n) \quad g(n) = n$

$\lim_{n \to \infty} \frac{\ln^2(n)}{n} = 0$ ~~since~~ ~~logs~~ grow slower

therefore statement is true

9) $f(n) = \ln^2(n) \quad g(n) = \sqrt{n}$

$\lim_{n \to \infty} \frac{\ln^2(n)}{\sqrt{n}} = 0$ since $\sqrt{n}$ grows faster

when $n = 1000{,}000$

$= \frac{339}{1000}$ therefore statement

is true

10) $f(n) = \ln^c n \quad g(n) = n^k$

$\lim_{n \to \infty} \frac{\ln^c n}{n^k} = 0$ therefore statement is true

(1) $f(n) = \ln(\ln(n))$ $g(n) = \ln(n)$

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

therefore statement is true

(2) $f(n) = 2^n$ $g(n) = 2^{n+1}$

$$\lim_{n \to \infty} \frac{2^n}{2^{n+1}} \to \frac{2^n}{2^n \cdot 2} \to \frac{1}{2}$$

$$\lim_{n \to \infty} \frac{1}{2}$$

therefore statement is true, $\frac{1}{2}$ is a constant.