

## Homework 2

1.

(a) Let  $f(n) = 3^{n+1}$  and  $g(n) = 3^n$ . Examine

$$\begin{aligned}\lim_{n \rightarrow \infty} \frac{f(n)}{g(n)} &= \lim_{n \rightarrow \infty} \frac{3^{n+1}}{3^n} \\ &= \lim_{n \rightarrow \infty} \frac{3 \cdot 3^n}{3^n} \\ &= \lim_{n \rightarrow \infty} 3 \\ &= 3\end{aligned}$$

Since 3 is a constant, then  $f(n) \in \Theta(g(n))$

(b) Let  $f(n) = 3^{3n}$  and  $g(n) = 3^n$ . Examine

$$\begin{aligned}\lim_{n \rightarrow \infty} \frac{f(n)}{g(n)} &= \lim_{n \rightarrow \infty} \frac{3^{3n}}{3^n} \\ &= \lim_{n \rightarrow \infty} \frac{(3^n)^3}{3^n} \\ &= \lim_{n \rightarrow \infty} 3^{2n} \\ &= \infty\end{aligned}$$

So  $f(n) \in \Omega(g(n))$ .