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3.1 Show that $\log(P(n))$ is $\Theta(\log n)$

$P(n) = \sum_{i=0}^{k} c_i n^k \quad c_i \geq 1$ for $0 \leq i \leq k$

$\log(cn^k) \geq \log n$ $\quad$ $\log(cn^k) \leq \log(n)$

$0 \leq n \leq n^k$ $\quad$ $0 \leq c \leq k$

$\log(n^k) \geq \log(n)$ $\quad$ $\log(On^k) \leq \log(n)$ $\therefore$ valid

if $k \geq 1$ $\therefore$ valid

$\therefore \log(P(n))$ is $\Theta(\log n)$

3.2 $\sum_{K=1}^{n} \log k$ is $O n \log n$

$\sum_{K=1}^{n} \log k = \log k + \log k+1 + \ldots + \log n$

$\lim_{K \to n} \sum_{K=1}^{n} \log k = \log((1)n)$

$0 \leq \log((1)n) \leq n \log n$ $\therefore$ valid

3.3 $f(n) = n^2$

$cnt \leq n^2$ $\quad$ $cnt \leq n^2$

if $n=5$ $cnt = 15$ $\quad$ if $n=0$ $cnt = 0$

$15 \leq 25$ $\therefore$ valid $\quad$ $0 \leq 0$ $\therefore$ valid

$\therefore cnt$ is $\Theta(n^2)$