

$$\begin{aligned}
\log(n!) &= \log(n) + \log((n-1)!) \\
&= \log(n) + \log(n-1) + \log((n-2)!) \\
&= \dots = \sum_{i=0}^n \log(n-i) \\
&= O(n \log(n)) \\
\\
&\Longleftrightarrow O(n \log(n)) = O(\log(n!))
\end{aligned}$$