Problem 3: Limits of Sequences

Find the limits of the following sequences. The first limit should be useful for the second one.

1. Let $y_n = \ln(n) - \dfrac{1}{n}\left(\ln(1) + \ln(2) + \cdots + \ln(n)\right)$. Find $\lim\limits_{n\to\infty} y_n$

2. $\lim\limits_{n\to\infty} \left(\dfrac{n^n}{n!}\right)^{\frac{1}{n}}$

As always, show your work, fully explain and justify your answer. A solution mainly obtained by computers or calculators will not be accepted.