Determine if the series converge

1. $\displaystyle\sum_{n=0}^{\infty} \frac{2}{\sqrt{2+n}}$

2. $\displaystyle\sum_{n=0}^{\infty} \frac{1}{n^2 + 2n + 2}$

3. $\displaystyle\sum_{n=0}^{\infty} \left(\frac{1}{2}\right)^n + \left(\frac{3}{5}\right)^n$

4. $\displaystyle\sum_{n=2}^{\infty} \frac{n\ln(n) + 4}{n^2}$

5. $\displaystyle\sum_{n=1}^{\infty} \left(\frac{1}{\pi}\right)^n$

6. Which of the following are true statement?

   (a) If $\displaystyle\lim_{n\to\infty} a_n = 0$, then $\sum_{n=1}^{\infty} a_n$ converges.

   (b) If $\displaystyle\lim_{n\to\infty} a_n \neq 0$, then $\sum_{n=1}^{\infty} a_n$ diverges.

   (c) If $\sum_{n=0}^{\infty} a_n$ converges, then $\displaystyle\lim_{n\to\infty} a_n = 0$.

7. Find a closed form expression for the partial sum, S_n, of the infinite series $\displaystyle\sum_{k=1}^{\infty} \ln\left(\frac{k+1}{k}\right)$

   Hint: $\ln(ab) = \ln(a) + \ln(b)$.

   Does the series converge or diverge?