What Series Convergence Test Do I Use?

(Q1.) $\displaystyle\sum_{n=1}^{\infty} \cos\left(\frac{1}{n^2}\right)$

(Q2.) $\displaystyle\sum_{n=1}^{\infty} 2^{-3n}7^n$

(Q3.) $\displaystyle\sum_{n=1}^{\infty} \frac{(-2)^n n!}{n^n}$

(Q4.) $\displaystyle\sum_{n=1}^{\infty} \frac{\sin(2n)}{n+3^n}$

(Q5.) $\displaystyle\sum_{n=2}^{\infty} \frac{\ln(n)}{n^2}$, hint: $\ln n < \sqrt{n}$ for all $n \geq 1$

(Q6.) $\displaystyle\sum_{n=1}^{\infty} \frac{3n+1}{\sqrt{n^5+4n^2+12}}$

(Q7.) $\displaystyle\sum_{n=3}^{\infty} \frac{1}{n\ln(n)}$

(Q8.) $\displaystyle\sum_{n=1}^{\infty} \left(1-\frac{1}{n}\right)^n$

(Q9.) $\displaystyle\sum_{n=1}^{\infty} \sin^2\left(\frac{1}{n}\right)$

(Q10.) $\displaystyle\sum_{n=1}^{\infty} \frac{(2n)!}{(n!)^2}$

(Q11.) $\dfrac{3}{5} - \dfrac{1}{5} + \dfrac{1}{15} - \dfrac{1}{45} + \dfrac{1}{135} - \cdots$

(Q12.) $\dfrac{\tan^{-1}(1)}{2} + \dfrac{\tan^{-1}(2)}{5} + \dfrac{\tan^{-1}(3)}{10} + \dfrac{\tan^{-1}(4)}{17} + \dfrac{\tan^{-1}(5)}{26} + \cdots$

(Q13.) $\dfrac{1}{4} - \dfrac{1}{7} + \dfrac{1}{10} - \dfrac{1}{13} + \dfrac{1}{16} - \cdots$

(Q14.) $\dfrac{1}{3} + \dfrac{1}{8} + \dfrac{1}{15} + \dfrac{1}{24} + \dfrac{1}{35} + \cdots$

(Q15.) $1 + \dfrac{1}{2^{\ln 2}} + \dfrac{1}{3^{\ln 2}} + \dfrac{1}{4^{\ln 2}} + \dfrac{1}{5^{\ln 2}} + \cdots$

Secret Weapons

The List: As $n \to \infty$

$\ln(n) \ll n^p \ll b^n \ll n! \ll n^n$

The Fact:
$$\lim_{n\to\infty} \left(1+\frac{a}{n}\right)^{bn} = e^{ab}$$

The Limit:
$$\lim_{\theta\to 0} \frac{\sin\theta}{\theta} = 1$$

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