Series Convergence Practice

Does each of the following series converge or diverge? Do the series which are never eventually positive nor eventually negative converge absolutely or conditionally or not at all? If you can compute the sum exactly, do so. Otherwise, if the series converges because of the integral test, the p-test, or the alternating series test, approximate the sum with an error term less than 0.0001 (if reasonable—I haven't checked these problems to see if there are any tough approximations).

Ex 1 $\displaystyle\sum_{n=5}^{\infty} ne^{-n^2}$

Ex 2 $\displaystyle\sum_{n=3}^{\infty} \frac{2+(-1)^n}{n^2}$

Ex 3 $\displaystyle\sum_{n=4}^{\infty} \frac{\ln(n)}{n}$

Ex 4 $\displaystyle\sum_{n=1}^{\infty} \frac{1+3^n}{5^n-1}$

Ex 5 $\displaystyle\sum_{n=2}^{\infty} \frac{n^{1.2}}{n^{2.1}-1}$

Ex 6 $\displaystyle\sum_{k=0}^{\infty} \frac{(2k)!\cdot(2k)!}{(3k)!}$

Ex 7 $\displaystyle\sum_{n=0}^{\infty} \frac{2^n}{1-5^{n-1}}$

Ex 8 $\displaystyle\sum_{n=0}^{\infty} \frac{e^n}{e^n+1}$

Ex 9 $\displaystyle\sum_{n=4}^{\infty} \frac{2^n}{(n^7+\ln(n))3^n}$

Ex 10 $\displaystyle\sum_{k=1}^{\infty} \frac{(-1)^{k+1}k^3}{1-3k^3}$

Ex 11 $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{n}+1}{n}$

Ex 12 $\displaystyle\sum_{n=1}^{\infty} \frac{8-5^n}{2^n}$

Ex 13 $\displaystyle\sum_{n=3}^{\infty} \frac{\sin^2(n)}{n^2}$

Ex 14 $\displaystyle\sum_{n=0}^{\infty} \frac{2}{n^3+5}$

Ex 15 $\displaystyle\sum_{n=0}^{\infty} \frac{2}{\sqrt{4n+90}}$

Ex 16 $\displaystyle\sum_{n=1}^{\infty} \frac{n^2-1}{3n^2+2n}$

Ex 17 $\displaystyle\sum_{m=1}^{\infty} \frac{(3m)^{2m}}{(2m)^{3m}}$

Ex 18 $\displaystyle\sum_{n=1}^{\infty} \frac{\cos(n\pi)}{\ln(n\pi)}$

Ex 19 $\displaystyle\sum_{n=2}^{\infty} \frac{\ln(n^2)}{2n^2\ln(n)}$

Ex 20 $\displaystyle\sum_{n=1}^{\infty} \frac{n!}{5^n\cdot n^3}$

Ex 21 $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n^3+1}}$

Ex 22 $\displaystyle\sum_{n=2}^{\infty} \frac{1}{(n+1)^{3/2}}$

(9) $\sum_{n=4}^{\infty} \frac{2^n}{(n^7+\ln(n))\,3^n}$

$$0 \le \frac{2^n}{(n^7+\ln(n))\,3^n} \le \frac{2^n}{3^n} = \left(\frac{2}{3}\right)^n$$

Since $\left|\frac{2}{3}\right| < 1$, the geometric series

$\sum_{n=4}^{\infty} \left(\frac{2}{3}\right)^n$ converges, so by the D.C.T $\sum_{n=4}^{\infty} \frac{2^n}{(n^7+\ln(n))\,3^n}$ converges

(16) $\sum_{n=?}^{\infty} \frac{n^2-1}{3n^2+2n}$

$$\frac{n^2-1}{3n^2+2n} \sim \frac{n^2}{3n^2} = \frac{1}{3}$$

$$\lim_{n\to\infty} \frac{n^2-1}{3n^2+2n} = \lim_{n\to\infty} \frac{n^2}{3n^2} = \frac{1}{3} \neq 0$$

By the div. test, $\sum_{n=?}^{\infty} \frac{n^2-1}{3n^2+2n}$ diverges