(1) Determine whether the series is convergent or divergent

(a) \( \sum_{n=1}^{\infty} \frac{1}{n^2 + 4} \)

(b) \( \sum_{n=2}^{\infty} \frac{1}{n \ln n} \)

(c) \( \sum_{n=1}^{\infty} \frac{e^{1/n}}{n^2} \)

(d) \( \sum_{n=3}^{\infty} \frac{n^2}{e^n} \)

(e) \( \sum_{n=1}^{\infty} (1 + \frac{1}{n})^2 e^{-n} \)

(f) \( \sum_{n=1}^{\infty} \sin(1/n) \)

(2) Explain why the integral test cannot be used to determine whether

\[ \sum_{n=1}^{\infty} \frac{\cos \pi n}{\sqrt{n}} \]

converges.

(3) Find all positive values of \( b \) for which the series

\[ \sum_{n=1}^{\infty} b^{\ln n} \]

converges.

(4) Approximate the sum of the series correct to 4 decimal places.

(a) \( \sum_{n=1}^{\infty} \frac{(-1)^{n-1} n^2}{10^n} \)

(b) \( \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{3^n n!} \)

(5) Suppose \( \sum_{n=1}^{\infty} a_n \) is a convergent series where each term \( a_n \) is positive. Is the series

\[ \sum_{n=1}^{\infty} \sin(a_n) \]

convergent?

(6) Show that the series \( \sum_{n=1}^{\infty} (-1)^{n-1} b_n \) where \( b_n = \frac{1}{n} \) when \( n \) is odd and \( b_n = \frac{1}{n\pi} \) when \( n \) is even, is divergent. Why does the alternating series test not apply?