Follow the the given guideline to answer all questions.

1. Apply an appropriate test to determine convergence of the series $\sum_{n=1}^{\infty} \left| \frac{(-1)^n \ln n}{n} \right|$

$$\sum_{n=1}^{\infty} \left| \frac{(-1)^n \ln(n)}{n} \right| = \sum_{n=1}^{\infty} \frac{\ln(n)}{n} > \sum_{n=1}^{\infty} \frac{1}{n}$$ p-series $p=1 \to$ diverges

The series $\sum_{n=1}^{\infty} \left| \frac{(-1)^n \ln(n)}{n} \right|$ diverges by comparison to the harmonic series

2. Apply an appropriate test to determine convergence of the series $\sum_{n=1}^{\infty} \frac{(-1)^n \ln n}{n}$

$\sum_{n=1}^{\infty} \frac{(-1)^n \ln(n)}{n}$ alternating $b_n = \frac{\ln(n)}{n}$ $\lim_{n\to\infty} b_n = 0$

The series $\sum_{n=1}^{\infty} \frac{(-1)^n \ln(n)}{n}$ converges by the alternating series test

3. Determine whether the series is absolutely convergent, conditionally convergent, or divergent.

$$\sum_{n=1}^{\infty} \frac{(-1)^n \ln n}{n}$$

The series is conditionally convergent since it is not absolutely converged but still converged when alternating.

4. Find s_6, the sum of the first six terms, of the series. Give your answr in exact form in the first line and also as a decimal rounded to 5 decimal places in the second line.

$$s_6 = \sum_{n=1}^{6} \frac{(-1)^n \ln n}{n} = 0 + \frac{\ln 2}{2} - \frac{\ln 3}{3} + \frac{\ln 4}{4} - \frac{\ln 5}{5} + \frac{\ln 6}{6}$$

$$\approx 0.30368$$

The remainder of the series $\sum_{n=1}^{\infty} a_n$ is defined by

$$R_n = s - s_n = a_{n+1} + a_{n+2} + a_{n+3} + \cdots$$

The Alternating Series Estimation Theorem provides the bound for the possible error R_n in the approximation of the sum of an alternating series.

5. Compute a bound for R_6. Give an exact value and also a decimal rounded to 5 decimal places. Write a paragraph to describe what this tells you about the approximation of the sum of the series by s_6.

$$|R_6| \leq b_{6+1} = \frac{(-1)^7 \ln 7}{7} = \frac{\ln 7}{7} \approx 0.27799$$

The value of R_6 tells you that S_6 can approximate the entire sum to an error of about 0.27799