Let $\sum a_n = \sum_{n=1}^{\infty} \frac{\boxed{(-1)^{n+1}}}{n} = +1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} \cdots$

$\sum a_n = \sum (-1)^n b_n$ where $b_n = \frac{1}{n}$

Since $\lim_{n \to \infty} b_n = 0$ and $b_{n+1} \leq b_n$ for $n > 1$,

$\sum a_n$ converges by alt. series test.

Let $S = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$, $S \approx S_4 = \sum_{n=1}^{4} \frac{(-1)^{n+1}}{n} = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}$

$|R_4| = |S - S_4| \leq \frac{1}{5}$

Larsen 9.5.43 Let $\sum a_n = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^3}$, find the number of terms to approximate the sum within 1/1000.

$\sum a_n$ converges by alt. Series test b/c $\lim_{n \to \infty} \frac{1}{n^3} = 0$

$\frac{1}{(n+1)^3} \leq \frac{1}{n^3}$ for $n \geq 1$.

$$|\text{Error}| = |S - S_N| \leq \boxed{\frac{1}{(N+1)^3} \leq \frac{1}{1000}}$$

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$$\frac{1}{(N+1)^3} \leq \frac{1}{1000}$$

$$(N+1)^3 \geq 1000$$

$$N+1 \geq (10^3)^{1/3}$$

$$N+1 \geq 10$$

$$N \geq 9, \quad S_9 = \sum_{n=1}^{9} \frac{(-1)^{n+1}}{n^3}, \quad \text{9 terms}$$