Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (not decimal approximations, if possible).

① $S = \sum_{n=1}^{\infty} (-1)^{n-1} \frac{1}{n \cdot 2^n}$

a) Why does this converge by the alternating series test?

b) Apply the ratio test. Does this converge absolutely?

c) Using the alternating series remainder estimate, what is the minimum number N of terms needed so that the partial sum S_N is accurate to 4 decimal places (i.e. the remainder is less than $\frac{1}{2} \times 10^{-4}$ in absolute value)?
[Hint: look at the sequence of numerical terms with Maple.]

d) If you round off S_N to 4 decimal places, does this agree with the 4 decimal place round off of Maple's 10 digit result for the infinite sum S?

e) Is S_N or $\text{round}_4(S_N)$ closer to S? (calculate the two differences)
If S is used in a step in a larger calculation, which number makes sense to use as an approximation for S: S_N or its 4 decimal place round off?