1. For each series, determine whether it converges absolutely, converges conditionally, or diverges.

(a) \[ \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^{1/3}} \]
(b) \[ \sum_{n=1}^{\infty} \frac{\cos(n)}{3^n} \]
(c) \[ \sum_{n=1}^{\infty} (-1)^{n-1}n^{1/3} \]
(d) \[ \sum_{n=1}^{\infty} (-1)^{n-1}n^2e^{-n^3/3} \]

2. You will need a calculator for parts (c) and (d).
Consider the series

\[ S = 1 - \frac{1}{2^{0.2}} + \frac{1}{3^{0.2}} - \frac{1}{4^{0.2}} + \frac{1}{5^{0.2}} + \cdots = \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^{0.2}} \]

(a) Show that \( S \) converges.
(b) Suppose we use the first five terms of the series (shown above) as an approximation of \( S \). What is the maximum error in our estimate, as guaranteed by the Alternating Series Approximation Theorem?
(c) Suppose we use the first \( N \) terms of the series as an approximation of \( S \). How large should \( N \) be to guarantee that the error in our estimate is at most \( 0.5 \times 10^{-5} \) (i.e., accurate to 5 decimal places)?
(d) The most powerful computer today has a performance of about 200 petaFLOPS (i.e., about \( 200 \times 10^{15} \) floating point operations per second). Suppose that the values of the \( N \) terms from part (c) were already calculated previously and stored in hard drive memory. Calculating the sum of these \( N \) terms then consists of \( N - 1 \) floating point operations (ignore the operations corresponding to table lookup). How long would it take for the most powerful computer to sum these \( N \) terms? Write your final answer in both seconds and days. (Yes, days.)