1. (10 pts) Answer the following Always True (T) or False (F). Only your final answers will be graded on these problems. Unless specified \( \sum \) refers to infinite sum. (1 pt each)
   a. Alternating series are monotonic
   b. If \( \sum a_n \) is a convergent series then \( \sum \frac{1}{a_n} \) is also a convergent series.
   c. If \( \sum a_n \) is a divergent series with positive terms then \( \sum (-1)^n a_n \) also divergent.
   d. Integral test can be used to calculate the exact sum of infinite series.
   e. Series \( \sum \sin(n) \) converges
   f. If \( \sum a_n \) and \( \sum b_n \) are series with positive terms \( a_n > b_n \) and \( \sum b_n \) diverges then \( \sum a_n \) also diverges.
   g. Ratio test can be used to prove that \( \sum n^{-1} \) diverges.
   h. Series \( \sum (-1)^n / n \) converges absolutely
   i. Remainder can be used to estimate the error of a partial sum
   j. If \( \sum a_n \) is a convergent series then \( \lim_{n \to \infty} a_n = 0 \)

2. (10 pts) Amount of money deposited in the bank account every month is given by the formula \( a_n = 100 \left( \frac{2^n + 4^n}{5^n} \right) \) where \( n \) is the month number starting with \( n=1 \). If initial account balance is $0, find the balance after a long time.

3. (10 pts) The terms of a series are defined recursively by the equation
   \[ a_1 = 2 \quad a_{n+1} = \frac{n}{n^2 + 2} a_n . \] Determine whether \( \sum a_n \) converges or diverges.

4. (10 pts) Determine whether the series \( \sum_{n=1}^{\infty} \frac{n}{n^3 - 1} \) is convergent or divergent.

5. (10 pts) Show that \( \sum_{n=1}^{\infty} \frac{5^n}{n!} \) converges.