1. Use the comparison test to determine whether the integral
\[ \int_0^{\pi/2} \frac{\sin^2 x}{x^2} \, dx \]
is convergent or divergent.

2. Determine whether each integral is convergent or divergent.
   a) \[ \int_2^3 \frac{1}{x^2 - x - 2} \, dx \]
   b) \[ \int_1^\infty \frac{1}{x^2 - 4x + 4} \, dx \]
   c) \[ \int_0^4 \frac{1}{\sqrt{x - 1}} \, dx \]

3. Find a formula for the general term \( a_n \) of the sequence \( \{2, -4, 6, -8, 10, \cdots \} \), assuming that the pattern of the first few terms continues.

4. Find a formula for the general term \( a_n \) of the sequence \( \{4, -1, \frac{1}{4}, -\frac{1}{16}, \frac{1}{64}, \cdots \} \), assuming that the pattern of the first few terms continues.

5. Write down an inductive formula for the general term \( a_n \) of the sequence \( \{1, 3, 4, 7, 11, 18, 29, \cdots \} \), assuming that the pattern of the first few terms continues.

6. Determine if the sequence \( \{a_n\}_{n=1}^{\infty} \) converges or diverges. If it converges, find the limit.
   a) \( a_n = \frac{n^3}{2n^3 - n} \).
   b) \( a_1 = 4, a_{n+1} = a_n + 3 \) for \( n \geq 2 \).
   c) \( a_n = \sqrt[n]{e^{3n+4}} \).

7. Determine if the sequence \( \{a_n\}_{n=1}^{\infty} \) converges or diverges. If it converges, find the limit.
   a) \( a_n = \frac{\tan^{-1} n}{n} \).
(b) $a_n = \frac{\sin \frac{\pi}{n}}{n}$.

(c) $a_n = \frac{3}{\sqrt{(2n-1)!/(2n+1)!}}$. Recall the factorial of a positive integer $k$ is defined as $k! = k \cdot (k-1) \cdot (k-2) \cdots 1$. 