1. Use l'Hôpital’s rule to evaluate the following limits. Make sure you indicate which indeterminate form
the limit is.

(a) \( \lim_{x \to \infty} e^{-x} \ln(x) \)
(b) \( \lim_{x \to 0^+} (1 + 2x)^{\frac{1}{x}} \)
(c) \( \lim_{x \to 0} \frac{1 - \cos(x)}{x^2} \)

2. Determine whether the following improper integrals converge or not. If the integral converges, give its
value.

(a) \( \int_{-\infty}^{0} -xe^{-x^2} \, dx \)
(b) \( \int_{0}^{2} \frac{1}{(2 - x)^{\frac{3}{4}}} \, dx \)
(c) \( \int_{-\infty}^{\infty} \frac{x}{1 + x^2} \, dx \)

3. Determine if the following sequences \( \{a_n\} \) converge or diverge. If the sequence converges, give the value
of the limit.

(a) \( a_n = \frac{n^{2/3}}{n^2 + 2} \)
(b) \( a_n = (-1)^n \frac{\sqrt{n}}{1 + n} \)
(c) \( a_n = 3^{-n} + \left( \frac{2}{5} \right)^n \)

4. Determine whether the following series converge or diverge. In the case of a convergent geometric series,
give the sum. Make sure you explain your work clearly.

(a) \( \sum_{k=1}^{\infty} (\cos(\pi/6))^k \)
(b) \( \sum_{k=1}^{\infty} \frac{k + 1}{1000k + 1} \)
(c) \( \sum_{k=2}^{\infty} \frac{2(-3)^k}{4k+1} \)