1. Let \( \alpha \) be a function defined by
\[
\alpha(x) = \begin{cases} 
0 & \text{if } x < 0, \\
\frac{1}{2} & \text{if } x = 0, \\
1 & \text{if } x > 0.
\end{cases}
\]
Prove that \( x^2 \in \mathcal{R}(\alpha) \) on \([-1, 1]\) and evaluate \( \int_{-1}^{1} x^2 \, d\alpha \).

2. Apply the integration by parts to evaluate the indefinite integral \( \int te^t \, dt \).

3. Prove that the series
\[
\sum_{n=1}^{\infty} \frac{1}{1 + n^2x}
\]
converges uniformly on \([1, \infty)\).

4. Let \( \{f_n\} \) be a sequence of continuous functions which converges uniformly to a function \( f \) on a metric space \( E \). Prove that
\[
\lim_{n \to \infty} f_n(x_n) = f(x)
\]
for every sequence of points \( x_n \in E \) such that \( x_n \to x \) and \( x \in E \).