1. Find the area and the perimeter of the fractal called Koch snowflake.

2. Let $f$ be a bounded function on $[a, b]$. Show that $L(f, P) \leq U(f, Q)$ for any two partitions $P$ and $Q$ of the segment.

3. Let $f(x) = x^3$. Consider partition $P_n = (0, 1/n, 2/n, ... n/n)$ of $[0, 1]$.
   Find $L(f, P_n), U(f, P_n), L(f), U(f)$, and $\int_0^1 f(x)dx$.

4. Give an example of a function which is not integrable on $[a, b]$, but $f^2$ is integrable on $[a, b]$.

5. Let $f$ be continuous and non-negative on $[a, b]$. Show that if $L(f) = 0$ then $f(x) = 0$ for all $x \in [a, b]$.

6. Let $S$ be a finite set of points on $[a, b]$. Let $f$ be bounded and $f(x) = 0$ for all $x$ outside from $S$. Show that $f$ is integrable and $\int_a^b f(x)dx = 0$.

7. Define $F : [0, 1] \rightarrow \mathbb{R}$ by $F(x) = x$, if $x$ is rational, and $F(x) = 0$ if $x$ is irrational.
   a) Show that $U(f, P) > 1/2$ for any partition $P$.
   b) Show that $\lim_{n \to \infty} U(f, P_n) = 1/2$ for $P_n = (0, 1/n, 2/n, ... n/n)$.
   c) Is the function integrable?

8. Extra Points Problem
   a) For which functions, if any, $|\int_a^b f(x)dx| = \int_a^b |f(x)|dx$ ?
   b) For which functions, if any, $|\int_a^b f(x)dx| > \int_a^b |f(x)|dx$ ?
   c) For which functions, if any, $|\int_a^b f(x)dx| < \int_a^b |f(x)|dx$ ?