Consider a function given by

1. Show that if is rational, then is not continuous at
2. Show that for any partition of
3. Show that for any the number of elements in the set

can be bounded by (Better bounds are possible, but not required.)

1. Using that is finite, show that is continuous at any irrational
2. Show that for any we can find a partition of such that
3. Deduce that is Riemann integrable and