Make sure to set up and appropriately end all proofs and cite any propositions that you use.

(1a) Show that \( m^*[a, b] = \text{length of } [a, b] \) for all closed intervals \([a, b]\).

(1b) Let \( A \subseteq \mathbb{R} \). Use the definition of \( m^* \) to construct/define a \( G_\sigma \) set (a \( \prod_\circ \) set; a countable intersection of open sets) \( B \) such that \( m^*B = m^*A \).
(Just the construction/definition of \( B \). No Proof required #1b.)

(2) Prove that \( \forall a \in \mathbb{R} \ (a, \infty) \) is a Lebesgue measureable set.

(3a) Suppose \( \{B_i \mid i \in \mathbb{N}\} \) is a sequence of Lebesgue measureable sets.

Define a Lebesgue measureable set \( C_i \) such that the \( C_i \)'s are pairwise disjoint and \( \bigcup_{i \in \mathbb{N}} C_i = \bigcup_{i \in \mathbb{N}} B_i \).
(Just the construction/definition of the \( C_i \)'s; no proof required in #3a)

(3b) Prove that if \( \{E_n \mid n \in \mathbb{N}\} \) is a pairwise disjoint of Lebesgue measureable sets, then \( \bigcup_{n \in \mathbb{N}} E_n \) is a Lebesgue measureable set.

(4) Show that there exists a set which is not Lebesgue measureable.