Proposition 1. *Any finite union of closed sets is closed, and any arbitrary intersection of closed sets is closed.*

Proof. Proposition 1
A, B $\in \tau \Rightarrow$ A $\cap$ B $\in \tau \Rightarrow \overline{A \cap B} \notin \tau$
$\overline{A \cap B} = \overline{A} \cup \overline{B}$
$\overline{A} \cup \overline{B} \notin \tau$

Also:
X = (a, z) $\in \tau$
A = (j, k) $\in$ X
$\overline{A}$ = (a, j] $\cup$ [k, z) $\notin \tau$ $\square$

Proposition 2. *A set K in a topological space X is closed if and only if K contains all its limit points.*

Proof. Proposition 2 Part 1 - Prove if K contains all its limit points then that implies X$\backslash$K $\in \tau$
$\exists$ x, z, $\alpha, \beta, \lambda, \epsilon \in$ X
K $\subseteq$ X, B $\subseteq$ X, C $\subseteq$ X
x, z $\in$ K, K = { y | x $\leq$ y $\leq$ z }
x, $\alpha, \beta \in$ B, B = $\{(\alpha, \beta) \mid \alpha <$ x $< \beta\}$
z, $\lambda, \epsilon \in$ C, C = $\{(\lambda, \epsilon) \mid \lambda <$ z $< \epsilon\}$
K $\cap$ B = [x, β), x $\neq \beta \therefore$ x is a limit point.
K $\cap$ C = (λ, z], z $\neq \lambda \therefore$ z is a limit point.
x, z $\in$ K, K = { y | x $\leq$ y $\leq$ z } $\therefore$ K is closed $\Rightarrow$ X$\backslash$K $\in \tau$

$\square$

Proof. Proposition 2 Part 2 - Prove if X$\backslash$K $\in \tau$ then that implies that K contains all of its limit points. $\square$