Working together is encouraged, share ideas not calculations. Explain your steps. This sheet must be printed and attached to your assignment as a cover sheet. The calculations and answers should be written neatly on one-side of paper which is attached and neatly stapled in the upper left corner. No fuzzies thanks. Box your answers where appropriate. Please do not fold. Thanks!

Problem 1 Restate each statement below as an implication using the words " If... then ..."

(a.) Whenever a function is a polynomial, it's continuous.

(b.) An exponential function must be positive.

(c.) A prime number greater than two cannot be even.

(d.) A differentiable function necessarily has a derivative.

Problem 2 Consider the sentence: *If a cat is good then* $0 = 1$. Given that all cats are not good, decide if the given sentence is true.

Problem 3 Suppose P, Q are true while S and T are false. Determine if the following compound statements are true or false,

(a.) $(P \vee S) \wedge (Q \vee T)$

(b.) $(P \wedge S) \vee (Q \wedge T)$

(c.) $(P \wedge Q) \Rightarrow (S \wedge T)$

(d.) $P \wedge \sim Q \Rightarrow \sim S$

Problem 4 Consider the following statement: "Goku has a flying nimbus, but his wife does not." Give appropriate definitions for a and b and translate our statement into a formal proposition in terms of a and b. Define and translate in such a way that your logical statement involves at least one negation.

Problem 5 Let a be the statement "Tomorrow is judgement day", b be "The cat is a robot", and c be "Trogdor burns the countryside". Write down a plain English version of the proposition using these translations of a, b, and c.

(a.) Proposition #1: $a \vee \sim b$

(b.) Proposition #2: $(a \wedge \sim b) \Rightarrow c$

(c.) Proposition #3: $\sim a \wedge (b \Rightarrow c)$

Problem 6 Prove $P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$

Problem 7 Prove $\{\sim (P \vee Q)\} \equiv \{\sim P \wedge \sim Q\}$

Problem 8 Prove $[P \wedge (P \Rightarrow Q)] \Rightarrow Q$ is a tautology.

Problem 9 Prove $[P \Rightarrow (Q \wedge \sim Q)] \Leftrightarrow \sim P$ is a tautology.

Problem 10 Prove $\{(P \wedge Q) \Rightarrow R\} \equiv \{\sim R \Rightarrow (\sim P \vee \sim Q)\}$

(a.) via a truth table proof,

(b.) via a column commented symbolic logic proof.