1. What do each of the following notations mean?

$\in$	element of; in	$\subset$	(proper) subset of	$\subseteq$	subset of
s.t or $\ni$	such that	$\exists$	there exists	$\exists!$ or $\exists\vert$	there exists a unique
$\rightarrow\!\leftarrow$	contradiction	$\therefore$	therefore	$\Longrightarrow$	implies
$\forall$	for all	$\equiv$	equivalent to	$\cong$	congruent to
iff	if and only if	BWOC	by way of contradiction	BYSC	beyond scope of course

2. Write the following mathematical statements as complete sentences.

(a). $A = \{x \in \mathbb{Z} \mid x \geq 5\}$

A is the subset of all integers x such that x is greater than or equal to 5.

(b). $\lim_{n\to\infty} s_n = 12$ Consider s_n to be a sequence.

The limit as n goes to infinity of the sequence s_n is 12.

(c). $A \Rightarrow B$ Note: The following notation is also equivalent $A \rightarrow B$ $B \leftarrow A$ $B \Leftarrow A$

A implies B. If A, then B. B is implied by A A is sufficient for B.

3. Explain why the following expressions are nonsense.

(a). Let x be an $\mathbb{Z}$.

$\mathbb{Z}$ is the set of all integers – not just the word "integer".

(b). $\{x | x \in A \cap x \in B\}$

You can only intersect sets and $x \in A; x \in B$ are statements not sets.

(c). $13 \subset \{x | x \text{ is a natural number}\}$

13 is an element in the set, but 13 is not a subset.

4. Using the list below,

(a). Which ones, if any, are proved? theorem, corollary, lemma, proposition

(b). Which ones, if any, are used to prove? definition, axiom, theorem, corollary, lemma, proposition

(c). Which ones, if any, are neither proven nor used to prove? conjecture

DEFINITION: The meaning of a word.

AXIOM/POSTULATE: Basic property/rule that is mutually agreed upon/accepted as a starting point.

THEOREM: Statement that can be proven from definitions, axioms, and other theorems.

COROLLARY: Direct consequence of previous theorem.

LEMMA: "Small theorem" usually used in the proof of another theorem.

PROPOSITION: Similar to Lemma. (I may refer to them as"Claims".)

CONJECTURE: Unproven statement – often highly suspect to being true.

5. Given the statement *If I go to Redfish Lake, then I waterski.* Write the following.

(a). Contrapositive: If I do not waterski, then I do not go to Redfish Lake.

(b). Converse: If I waterski, then I go to Redfish Lake.

(c). Inverse: If I do not go to Redfish Lake, then I do not waterski.

Which of Contrapositive, Converse, Inverse, and the Original Statement are equivalent to each other?
Contrapositive is equivalent to the original statement. Inverse and Converse are equivalent to each other, but not to the original statement.

6. Rewrite the following statement in "If-then" form. *Prove that every rational number is algebraic.*
If x is a rational number, then x is algebraic.