Problem # 5
a) Let $A$ and $B$ be sets. Prove that $A \cup B = A$ if and only if $B \subseteq A$.
b) Prove that $(A \setminus C) \cap (B \setminus C) = (A \cap B) \setminus C$ for all sets $A, B, C$.

Problem # 6
Which if the following statements are true and which are false? Give proofs or counterexamples.
a) For any sets $A, B, C$ we have
$$A \cup (C \cap C) = (A \cup B) \cap (A \cup C).$$
b) For any sets $A, B, C$ we have
$$(A \setminus B) \setminus C = A - (B \setminus C).$$
c) For any sets $A, B, C$ we have
$$(A \setminus B) \cup (B \setminus C) \cup (C \setminus A) = A \cup B \cup C.$$

Problem # 7
Work out $\bigcup_{n=1}^{\infty} A_n$ and $\bigcap_{n=1}^{\infty} A_n$ for the following sets
a) $A_n = \{x \in \mathbb{R} \mid x > n\}$
b) $A_n = \{x \in \mathbb{R} \mid \frac{1}{n} < x < \sqrt{2} + \frac{1}{n}\}$
c) $A_n = \{x \in \mathbb{R} \mid -n < x < \frac{1}{n}\}$
d) $A_n = \{x \in \mathbb{R} \mid \sqrt{2} - \frac{1}{n} < x < \sqrt{2} + \frac{1}{n}\}$

Problem # 8
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Problem # 9
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