Check distributive laws for $\cup, \cap$ and de morgans laws

---

distributive 1

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

"$\subset$" $x \in A \cap (B \cup C)$, x in A and x in $B \cup C$

thus $x \in A \cap B$ or $x \in A \cap C$

"$\supset$"

$x \in A \cap B$ or $x \in A \cap C$

if $x \in A \cap B$ then $x \in B \cup C$

if $x \in A \cap C$ then $x \in B \cup C$

Since $x \in A$, $x \in A \cap (B \cup C)$ $\blacksquare$

---

distributive 2:

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

"$\subset$" if $x \in A$ then $x \in (A \cup B) \cap (A \cup C)$

if $x \in B \cap C$ then $x \in (A \cup B)$ and $x \in (A \cup C)$

So $x \in (A \cup B) \cap (A \cup C)$

"$\supseteq$" if $x \in A$ then

$x \in A \cup (B \cap C)$.

if $x \notin$ then $x \in B$ and $x \in C$ so

$x \in B \cap C \rightarrow x \in A \cup (B \cap C)$ $\blacksquare$

De morgans laws

$$A-(B \cup C) = (A-B) \cap (A-C)$$

"$\subseteq$" $x \in A$, $x \notin B \cup C \rightarrow x \notin B$ and $x \in C$

$\rightarrow x \in A-B$ and $x \in A-C$

$\Leftrightarrow$ $x \in (A-B) \cap (A-C)$

"$\supseteq$" $x \in (A-B) \rightarrow x \in A$, $x \notin B$

$x \in A-C \rightarrow x \notin C \longrightarrow x \notin B \cup C$

$\rightarrow x \in A-(B \cup C)$ $\blacksquare$

$$A-(B \cap C) = (A-B) \cup (A-C)$$

"$\subseteq$": $x \in A$, if $x \notin B$ then $x \in A-B$

if $x \notin C$ then $x \in A-C$

"$\supseteq$"

if $x \in A - B$ then $x \notin B$ so $x \notin B \cap C$

$\rightarrow x \in A - B \cap C$

if $x \in A - C$ then $x \notin C$ so $x \notin B \cap C$

$\rightarrow x \in A - B \cap C$