Assignment 4 Part 1

Friday, January 29, 2016 5:35 PM

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6.1-12 Let the universal set be the set R for all real numbers and let

$A = \{x \in R \mid -3 \le x \le 0\}$ $\{-3, -2, -1, 0\}$

$B = \{x \in R \mid -1 < x < 2\}$ $\{0, 1\}$

$C = \{x \in R \mid 6 < x \le 8\}$ $\{7, 8\}$

a) $A \cup B$ $\{-3, -2, -1, 0, 1\}$

b) $A \cap B$ $\{0\}$

c) A^c $\{x \in R \mid 6 < x < 9\}$

d) $A \cup C$ $\{-3, -2, -1, 0, 1, 7, 8\}$

e) $A \cap C$ $\{\emptyset\}$

f) B^c $\{x \in R \mid -1 < x < 2\}$

g) $A^c \cap B^c$ $\{x \in R \mid -1 < x < 9\}$

h) $A^c \cup B^c$ $\{x \in R \mid -4 < x < 2\}$

i) $(A \cap B)^c$ $= \{0\}^c = \{x \in R \mid -1 < x < 1\}$

j) $(A \cup B)^c$ $\{x \in R \mid -4 < x < 2\}$

6.1-16 Let $A = \{a, b, c\}$ $B = \{b, c, d\}$ $C = \{b, c, e\}$

a) $A \cup (B \cap C)$, $(A \cup B) \cap C$ and $(A \cup B) \cap (A \cup C)$ which of these sets are equal

distributive property

$(A \cup B) \cap (A \cup C)$, $(A \cap C) \cup (B \cap C)$ and $(A \cup B) \cap (A \cup C)$

the first and third are equal

$\{a, b, c, d\} \cap \{a, b, c, e\}$

$\{a, b, c\}$

$\{b, c\} \cup \{b, c\}$

$\{b, c\}$

b) $A \cap (B \cup C)$, $(A \cap B) \cup C$ and $(A \cap B) \cup (A \cap C)$

Same as the question before

distributive property

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

the first and third equal

$\{a, b, c\}$

Same as the question before

$\{b, c\}$

c) $(A - B) - C$ and $A - (B - C)$

$\{x \in U \mid x \in A$ or $x \in B\}$

$\{a\} - \{b, c, e\}$ $\{a, b, c\} - \{d\}$

$\{a\}$ $\neq$ $\{a, b, c\}$

they are not equal

6.2-4 The following is a proof that for all sets A and B if $A \subseteq B$ then $A \cup B \subseteq B$

Proof Suppose A and B are any sets and $A \subseteq B$. [We must show that $A \cup B \subseteq B$]

Let $x \in R$ [we must show that $A \cup B \subseteq B$] By definition of Union $x \in R \mid x \in A$ $x \in B$. In case $x \in A \cup B$, then since $A \subseteq B$, $x \in A$ In case $x \in B$, then clearly $x \in B$, So in either case $x \in B$ [as was to be shown]

6.2-10

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

We must show that $(A - B) \cap (C - B) \subseteq (A \cap C) - B$ and $(A \cap C) - B \subseteq (A - B) \cap (C - B)$

based on the distributive property

$(A - B) \cap (C - B) \subseteq (A - B) \cap (C - B)$

6.2-14 For all sets A, B, and C, if $A \subseteq B$ then $A \cap C \subseteq B \cap C$

if $A \subseteq B$ then we know that $x \in B$ and $x \in A$

$A \cap C = x \in A \cap x \in C$

$B \cap C = (x \in B$ and $x \in A) \cap x \in C$

6.3 - 12 $A \cap (B - C) = (A \cap B) - (A \cap C)$

$x \in A \cap (B - C)$ = $x \in A$ $x \in B$ $x \notin C$

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

$(x \in A$ and $x \in B)$ $(x \in A - x \in C)$

$x \in A$ $x \in B$ $x \notin C$

6.3 - 37 For all sets A and B

$B^c \cup (B^c - A)^c = B$

$B^c \cup (B^c \cap A^c)^c) = B$ set difference law

$B^c \cup (B \cup A) = B$ de morgan's law

$(B^c \cup B) \cup A = B$ associative law

$U \cup A$ contemplative law

U universal bond law

I believe 37 is wrong

$+ \quad (B^c - A)^c$

$(B^c - B) \quad + \quad ((U - B) - A)^c$

$(U - B) \quad + \quad (U - B - A)^c$

$U - B \quad + \quad A + B$

$U + A$

U

6.3 - 42 $(A - (A \cap B)) \cap (B - (A \cap B))$

$(A \cap (A \cap B)^c) \cap (B \cap (A \cap B)^c)$ Demorgans law

$A \cap (A^c \cup B^c) \cap (B \cap (A^c \cup B^c))$ set diffnce

$(A \cap A^c) \cup (A \cap B^c) \cap (B \cap A^c) \cup (B \cap B^c)$ distributive law

$(\emptyset) \cup (A \cap B^c) \cap (B \cap A^c) \cup (\emptyset)$ contemplative law

$A \cap B^c \cap B \cap A^c$ identity law

$(B^c \cap B) \cap (A \cap A^c)$ associative law

$\emptyset \cap \emptyset$

$\emptyset$