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Tutorial - 5

Q.1 Give power sets of the following.
a) $\{a, \{b\}\}$.
→ Power Sets = $\{a\}, \{\{b\}\}, \{\phi\}, \{a, \{b\}\}$

b) $\{1, \phi\}$
→ Power sets = $\{1\}, \{\phi\}, \{1, \phi\}, \phi$

Cardinality (No of elements)
$\phi = 0$
$\{\phi\} = 1$.

Q.2 Show that $(R \subseteq S) \wedge (S \subset Q) \Rightarrow R \subset Q$.
→ $(R \subseteq S) \wedge (S \subset Q) \Rightarrow R \subset Q$.

$\therefore R \subseteq S = (x)(x \in R \rightarrow x \in S)$
$S \subset Q = (x)(x \in S \rightarrow x \in Q \wedge S \neq Q)$

$\therefore (x)(x \in R \rightarrow x \in S) \wedge (x)(x \in S \rightarrow x \in Q \wedge S \neq Q)$
$\longrightarrow (x)(x \in R \rightarrow x \in Q) \wedge R \neq Q$
OR.
If $(A \subset B) \cdot \wedge (B \subset C)$ then $(A \subset C)$
If $(A = B) \wedge (B \subset C)$ then $(A \subset C)$
$(A \subset B) \wedge (B \subset C) \rightarrow A \subset C$.
OR $(A = B) \wedge (B \subset C) \rightarrow A \subset C$.

Q.3 Show that $A \cap B \subseteq A$
→ $A \cap B = (x)(x \in A \wedge x \in B) \Rightarrow (x)(x \in A)$

Q. $A = \{2, 3, 4\}$, $B = \{1, 2\}$, $C = \{4, 5, 6\}$

→ $A + B = \{1, 3, 4\}$

$A + B + C = \{1, 3, 5, 6\}$

$(A+B) + (B+C) = \{1, 3, 4\} + \{1, 2, 4, 5, 6\}$

$= \{2, 3, 5, 6\}$.

OR.

$(A+B) + (B+C) = A + \underline{B + B} + C$

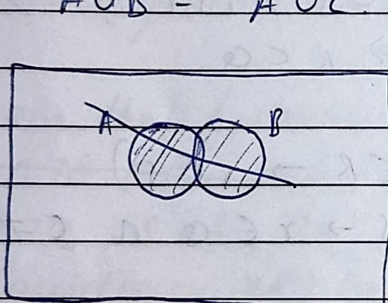
$= A + \phi + C$

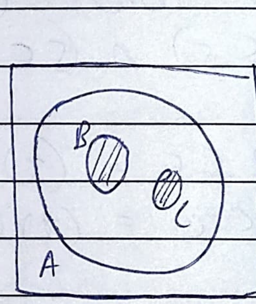
$= A + C$

$= \{2, 3, 5, 6\}$.

Q. Give examples of sets A, B, C such that, $A \cup B = A \cup C$ but, $B \neq C$.

→ $A \cup B = A \cup C$





$\{\phi, \{\phi\}\} - \{\phi\} = \{\{\phi\}\}$

Q. $A = \{2\}$, $B = \{a, b\}$, $C = \{2, 3\}$. Find $A \times B$, A^2, B^2, $B^2 \times C$

→ $\underline{A \times B} = \{\langle 2, a\rangle, \langle 2, b\rangle\}$

1 Pair. $\underline{A^2} = \{\langle 2, 2\rangle\}$

4 Pairs ← $\underline{B^2} = \{\langle a, a\rangle, \langle a, b\rangle, \langle b, a\rangle, \langle b, b\rangle\}$

8 Pairs. ← $\underline{B^2 \times C} = \{\langle\langle a, a\rangle, 2\rangle, \langle\langle a, a\rangle, 3\rangle, \langle\langle a, b\rangle, 2\rangle, \langle\langle a, b\rangle, 3\rangle,$
$\langle\langle b, a\rangle, 2\rangle, \langle\langle b, a\rangle, 3\rangle, \langle\langle b, b\rangle 2\rangle, \langle\langle b, b\rangle, 3\rangle\}$

OR $\{\langle a, a, 2\rangle, \ldots\}$

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Q. Show that for any two sets A and B, $P(A) \cup P(B) \subseteq P(A \cup B)$

→ $P(A) \cup P(B) \Leftrightarrow (x)(x \in P(A) \vee x \in P(B))$

$\Leftrightarrow (x)(x \subseteq A \vee x \subseteq B)$

$\Leftrightarrow (x)(x \subseteq A \cup B)$

$\therefore P(A) \cup P(B) \subseteq P(A \cup B)$

Q. Show that $A \times (B \cap C) = (A \times B) \cap (A \times C)$.

→

Q. Prove that $(A \cap B) \cup (A \cap \sim B) = A$.

→ $(A \cap B) \cup (A \cap \sim B)$

$\Rightarrow (x) | (x \in A \wedge x \in B) \cup (x) | (x \in A \wedge x \in \sim B)$

$\Rightarrow (x) | (x \in A)$

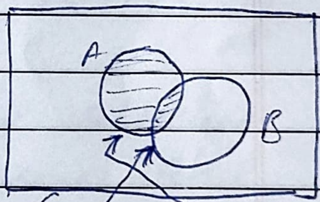
$\Rightarrow A$.

OR

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

$= A \cap E$

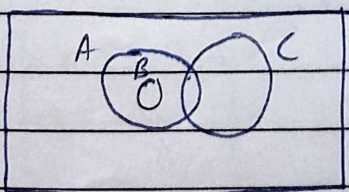
$= A$



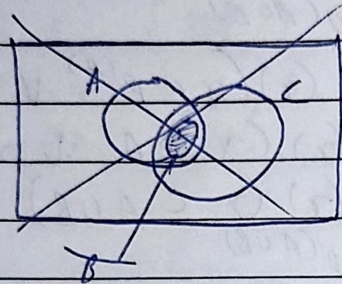
$\therefore (A \cap B) \cup (A \cap \sim B) = A$.

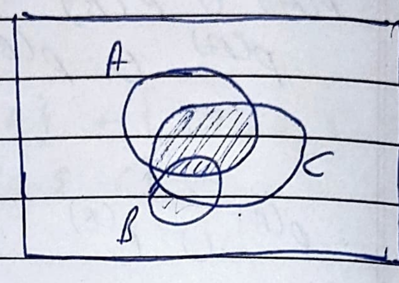
Q. Draw venn diagram.

i) $A \cup B \subseteq A \cup C$: $B \nsubseteq C$



2) $A \cap B \subset A \cap C$, $B \not\subseteq C$





Q. Prove that $(A \cap B) \times (C \times D) = (A \times C) \cap (B \times D)$

$$
\begin{array}{c|cccccccc}
 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\hline
-3 & 00 & 01 & 02 & & & & & \\
-2 & & & & & & & & \\
-1 & & & & & & & & \\
0 & & & & & & & & \\
1 & & & & & & & & \\
2 & & & & & & & & \\
3 & & & & & & & & \\
4 & & & & & & & & \\
5 & & & & & & & & \\
6 & & & & & & & &
\end{array}
$$

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$A[2,7] = b_0 + (-1+4-1)\cdot 8 + (10-3)$
$= b_0 + (2 * 8) + 7$

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