☐ set

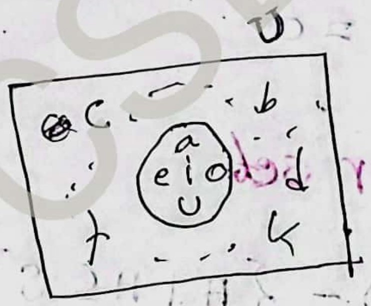
$V = \{a, e, I, O, U\}$

$a \in V$ means a is a member of V

* U is the set of all English letter

V is the set of all vowels

$V \subseteq U$



☐ Write down the following set in roster method

$J = \{x \mid x$ is a member of the original Avengers$\}$

$= \{$Ironman, captain Americn, Halk, Black widow, Hawkeye$\}$

$N \in Z \in Q \subset R$

$N = \{0, 1, 2, 3 \ldots\}$

$Z = \{-2, -1, 0, 1, 2 \ldots\}$

$Z^+ = \{1, 2, 3 \ldots\}$

$Q = \{\frac{-7}{2}, \frac{8}{2} \ldots\}$

$Q^+ = \{\frac{7}{2}, \frac{8}{2} \ldots\}$

$R = \{-0.1110, 1.0725 \ldots\}$

Cardinality of finite set

$V = \{a, e, i, o, u\}$

cardinality of $V_1 = |V| = 5$

Empty set

$|\emptyset| = 0$

$|P(S)| = 2^{|S|} = 2^n$

Power set

$P(S) = \{A \mid A \subseteq S\}$

$P(\{1, 2\}) = \{\{1\}, \{2\}, \{1,2\}, \emptyset\}$

$S = \{1, 2, 3\}$

$P(S) = \{\{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}, \{1,2,3\}, \emptyset\}$

{ cardinality মানে সেট এর সংখ্যা }

Set

Cartesian product

* $A \times B = \{(x, y) \mid x \in A \wedge y \in B\}$

{ক্রমজোড় / Order pair}

$\{1, a\} = \{a, 1\}$

$\{1, a\} \neq \{a, 1\}$

$A = \{1, 2, 3\}$. $B = \{a, b\}$

$\therefore A \times B = \{(1, a), (1, b), (2, a), (2, b), (3, a), (3, b)\}$

$$\text{cardinality} = 3 \times 2 = 6$$

$$\boxed{\begin{matrix} A = \{1, 2, 3\} \\ B = \{a, b\} \end{matrix}}$$

* $A = \{1, 2\}$, $B = \{a, b\}$, $C = \{\alpha, \beta\}$

$\therefore A \times B \times C = \{(1, a, \alpha), (1, a, \beta), (1, b, \alpha), (1, b, \beta), (2, a, \alpha), (2, a, \beta), (2, b, \alpha), (2, b, \beta)\}$

[সব প্রকারে গুন করতে হবে]

* $A = \{a, b\}$, $B = \{c, d\}$, $C = \{e, f\}$

$A \times B \times C = \{(a, c, e), (a, c, f), (a, d, e), (a, d, f), (b, c, e), (b, c, f), (b, d, e), (b, d, f)\}$

Restricting quantifiers with sets

$\forall x \in \mathbb{R} (x^2 \geq 0) \rightarrow$ True.

$\exists x \in \mathbb{Z} (x^2 = 1) \rightarrow$ True.

* $P(x) \equiv (x^2 > x)$

For which values of x will $P(x)$ be true?

① Any real number larger than 1

② " real " less than 0

$P(x) \equiv |x| = 1 \rightarrow \{x \in \mathbb{R} \mid |x| = 1\} = \{1, -1\}$

$Q(x) \equiv |x| = x$. $\quad \mathbb{R}^+ / [0, \infty] / 0 \leq x \leq \infty$

$\{x \in \mathbb{R} \mid x \geq 0\}$

$R(x) \equiv x + 1 > x \longrightarrow \{\mathbb{R}\}$

$P(x) \equiv x^2 > x$ $\quad \{x \in R \mid (x>1) \vee (x<0)\} / R-[0,1]$

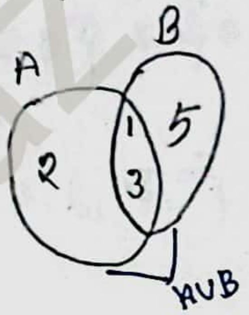
$Q(x) \equiv x+1 \leq x$ $\quad \{\phi\}$

$R(x) \equiv x^2 = 4$ $\quad \{-2, 2\}$

Union set

$A = \{1, 2, 3\}$; $B = \{1, 3, 5\}$ $\quad A \cup B = \{x \mid x \in A \vee x \in B\}$

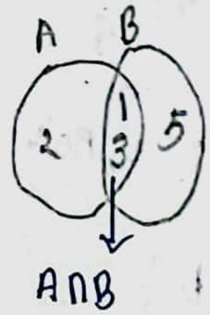
$A \cup B = \{1, 2, 3, 5\}$



Intersection set

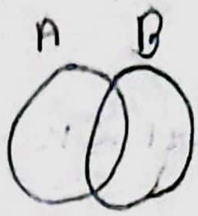
$A = \{1, 2, 3\}$. $B = \{1, 3, 5\}$ $\quad A \cap B = \{x \mid (x \in A) \wedge (x \in B)\}$

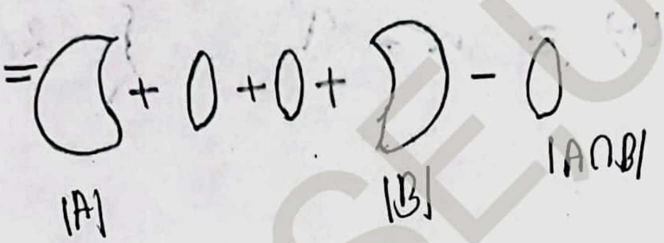
$A \cap B = \{1, 3\}$



⊞ Cardinality of union set

$|A \cup B| = |A| + |B| - |A \cap B|$

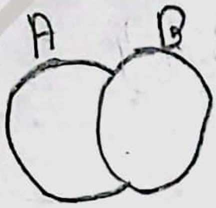




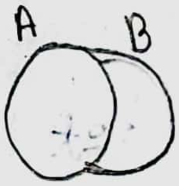
⊞ Difference

$A = \{1, 2, 3\}$ $B = \{1, 3, 5\}$ $A - B = \{x \mid (x \in A) \cap x \notin B\}$

$A - B = \{2\}$



$B - A = \{5\}$



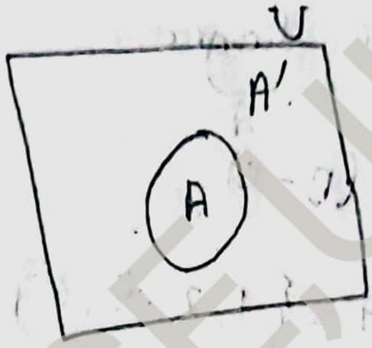
$A = \{1, 3, 9, 10, 12\}$ $B = \{1, 5, 12\}$

$\Rightarrow A - B = \{3, 9, 10\}$

$B - A = \{5\}$

complement of a set

$A' = U - A$



$U = \{1, 2, 3, 4, 5, 6\}$

$A = \{2, 5, 6\}$

$A' = U - A$
$= \{1, 3, 4\}$

Given that $A = \{0, 2, 4, 6, 8\}$, $B = \{0, 1, 2, 3, 4\}$, $C = \{0, 3, 6, 9\}$

$A \cup B \cup C = \{0, 1, 2, 3, 4, 6, 8, 9\}$

$A \cap B \cap C = \{0\}$

$U = \{0, 1, 2, 3, 4, 6, 8, 9\}$

$A - (B \cap C)'$

$\therefore B \cap C = \{0, 3\}$

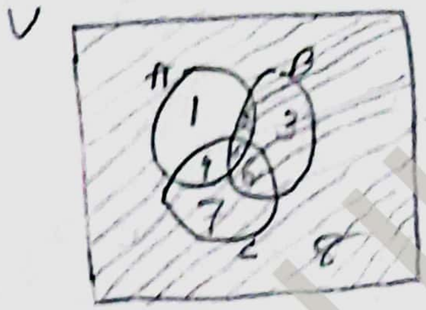
$\therefore (B \cap C)' = U - (B \cap C)$
$= \{\cancel{0} 1, 2, 4, 6, 8, 9\}$

$\therefore A - (B \cap C)'$
$= \{0, 2, 4, 6, 8\} - \{1, 2, 4, 6, 8, 9\}$
$= \{0,\}$

problem

Draw diagram

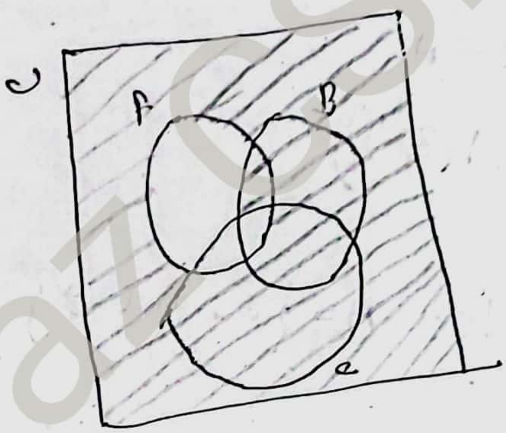
$A' \cup (B - C)$



$A = \{1, 2, 4, 5\}$

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

$C = \{4, 5, 6, 7\}$



$\therefore A' = U - A$

$= \{3, 6, 7, 8\}$

$B - C = \{2, 3\}$

$A' \cup (B - C) = \{2, 3, 6, 7, 8\}$

Generalized union and Intersection

$$\sum_{i=1}^{n} a_i = a_1 + a_2 + \cdots + a_n$$

$$\prod_{i=1}^{n} a_i = a_1 a_2 a_3 \cdots a_n$$

$$\bigcup_{i=1}^{n} A_i = A_1 \cup A_2 \cup \cdots \cup A_n$$

$$\bigcap_{i=1}^{n} A_i = A_1 \cap A_2 \cap \cdots \cap A_n$$

* $A_1 = \{1, 2, 3, 4\}$

$A_2 = \{2, 4, 6, 8\}$

$A_3 = \{4, 8, 12, 16\}$

$$\bigcup_{i=1}^{3} A_i = A_1 \cup A_2 \cup A_3 = \{1, 2, 3, 4, 6, 8, 12, 16\}$$

$$\bigcap_{i=1}^{3} A_i = A_1 \cap A_2 \cap_3 = \{4\}$$

problem

A Let $A_i = \{i, i+1, i+2, \dots\}$

Find out, $\bigcup_{i=1}^{n} A_i$, and $\bigcap_{i=1}^{n} A_i$

$A_1 = \{1, 2, 3, 4, 5 \dots\}$

$A_2 = \{2, 3, 4, 5 \dots\}$

$A_3 = \{3, 4, 5 \dots\}$

$A_2 \subseteq A_1$ / $A_3 \subseteq A_1$

$\bigcup_{i=1}^{n} A_i = A_1$

$\bigcap_{i=1}^{4} A_i = \{4, 5, 6 \dots\}$

* $\bigcap_{i=1}^{n} A_i = \{A_n\}$

problem

Let $A_i = \{1, 2, 3, \dots i\}$

$A_1 = \{1\}$

$A_2 = \{1, 2\}$

$A_3 = \{1, 2, 3\}$

$A_4 = \{1, 2, 3, 4\}$

$\bigcup_{i=1}^{\infty} A_i = \cancel{A_4 = \{1, 2, 3, 4\}}$ A_∞

$\bigcap_{i=1}^{\infty} A_i = \{1\} = A_1$.