Math (sets)

Set

a) extension form   b) Comprehension form

a) extension form (Roster notation)

$A = \{4, 6, 3, 2, 12, 1\}$ ⇒ set of divisors of 12

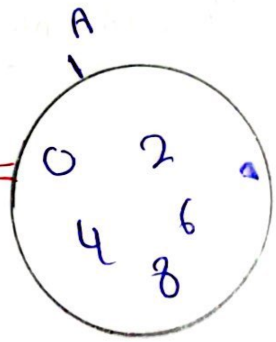
b) Comprehension form (set builder notation)

$A = \{x \overset{\text{such that}}{/} x \text{ is a divisor of } 12\}$.

$B = \{x / 0 \leqslant x \leqslant 12\}$

Venn diagram:

$A = \{0, 2, 4, 6, 8\}$ ⇐



Remark:

$\in$: belong.

$\notin$: doesnot belong.

$\subset$: subset.

$\not\subset$: does not subset.

$\emptyset$: phi ⇒ empty set

$\cap$: intersection

$\cup$: union.

$\underbrace{\_\_ \times \_\_}_{\text{divisors}} = \underbrace{\_\_\_}_{\text{multiples}}$

Finite and infinite sets:

$B = \{1, 3, 5, 7, 9\}$ ⇓ Finite set ⇓ $Card(B) = 5$

Card ↙ Cardinal

(B) ↘ number of elements of B.

$C = \{x / x$ is an odd number$\}$ ⇓ Infinite set.

Remarks

1) Equal sets: having same elements.
2) singleton: contains only one element.
3) Pair: contains two elements.
4) If $A \subset B$ and $B \subset C$

$$\Rightarrow A \subset C$$

5) $A \subset B$ and $B \subset A$ if and only if $A = B$.
6) $A \subset A$

$\emptyset \subset A$ for any set A.

Complement of a set:

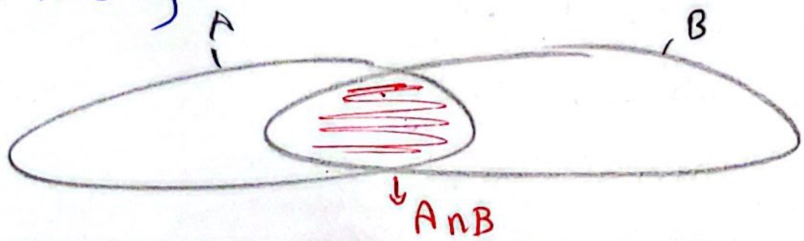
it is denoted by $\bar{A}$ or C_E^A

$$\Rightarrow \bar{A} = C_E^A = \{x / x \in E \text{ and } x \notin A\}$$

Operations with sets:

1) Intersection:

$$A \cap B = \{x / x \in A \text{ and } x \in B\}$$



Remark:

1) disjoint sets: $E = \{x / x \text{ is even}\}$, $F = \{x / x \text{ is odd}\}$ $\Rightarrow$ disjoint sets.

2) $A \cap B = B \cap A$

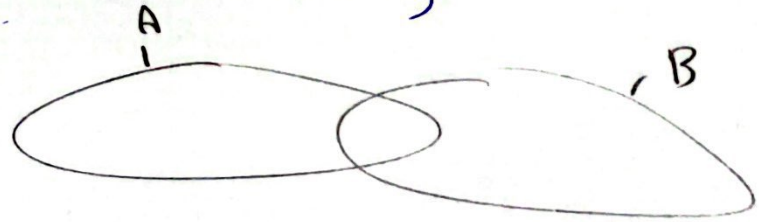
3) $A \cap A = A$

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

5) $A \cap \emptyset = \emptyset$

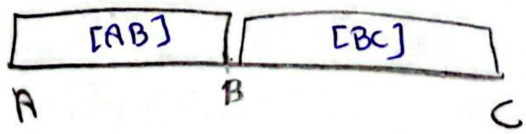
2) Union:

$A \cup B = \{x / x \in A \text{ or } x \in B\}$



Remarks:

1) If A, B and C are 3 collinear points in their order
$\Rightarrow [AB] \cup [BC] = [AC]$



2) $A \cup B = B \cup A$

3) $A \cup \emptyset = A$

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

5) $A \cup A = A$

6) $A \cup \bar{A} = E$ $\Rightarrow$ reference set

7) $A \cap \bar{A} = \emptyset$

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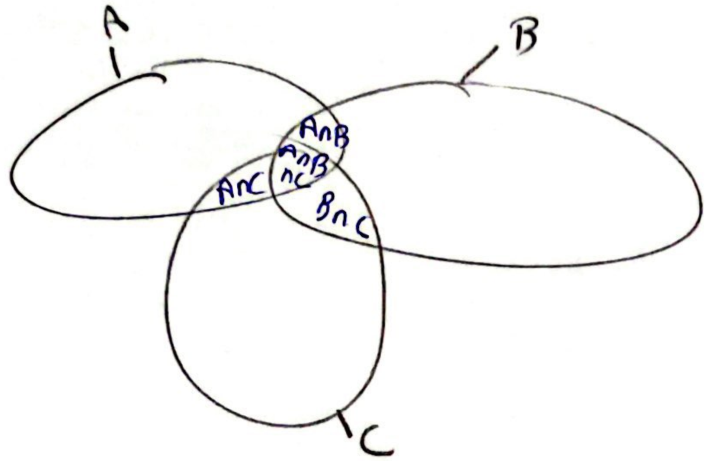
8> $Card(A \cup B) = Card(A) + card(B) - Card(A \cap B)$

9) To prove two complement sets:

prove $A \cap \bar{A} = \emptyset$

and $A \cup \bar{A} = E$

10)



The Set of Subsets:

$E = \{a; b; c\}$

1) $\emptyset \subset E$

2) singletons: $\{a\} \subset E$

$\{b\} \subset E$

$\{c\} \subset E$

3) pairs: $\{a; b\} \subset E$

$\{a; c\} \subset E$

$\{b; c\} \subset E$

4) $E \subset E$: $\{a; b; c\} \subset E$

$\mathcal{P}(E) = \{\emptyset; \{a\}; \{b\}, \{c\}, \{a; b\}; \{a; c\}; \{b; c\}; \{a; b; c\}$

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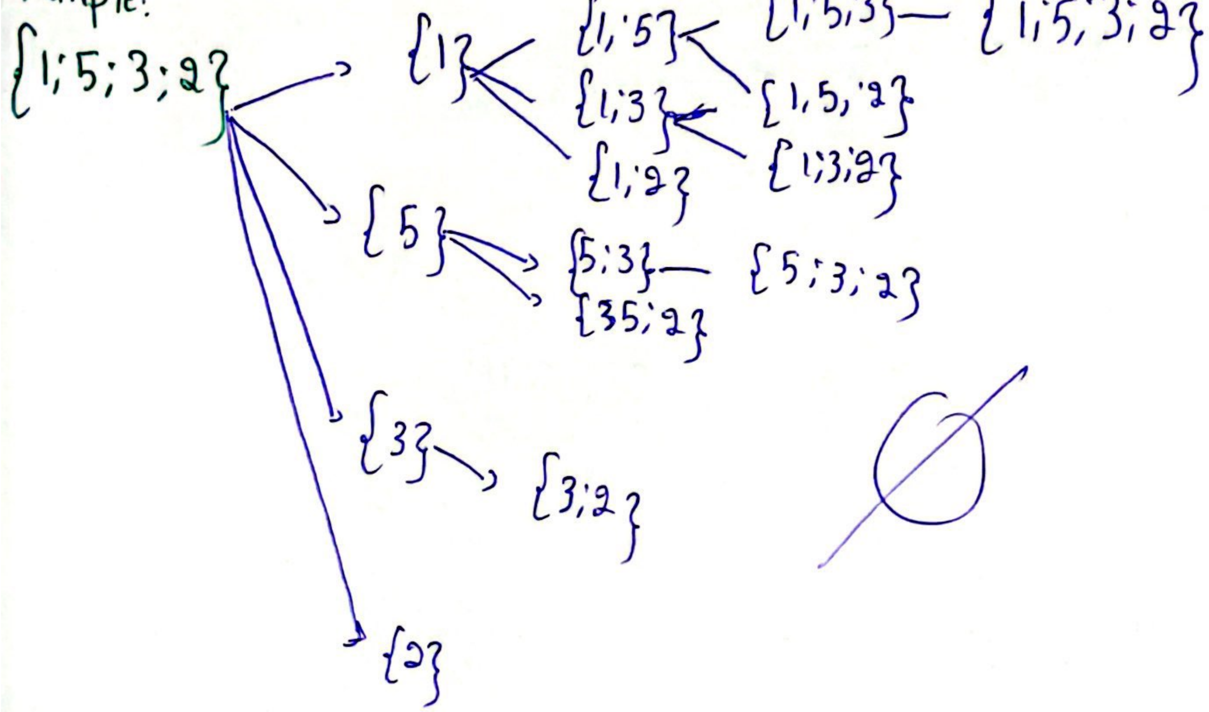
· Card $\mathcal{P}(E) = 8 = 2^3 \to$ Card (E)

example:



Sets of Numbers:

1) Natural and whole numbers:

$$\mathbb{N} = \{0; 1; 2; 3 \dots\}$$

2) Integers:

$$\mathbb{Z} = \{\dots -3; -2; -1; 0; 1; 2; 3 \dots\}$$

$$\mathbb{N} \in \mathbb{Z}$$

3) Decimal number

$$\mathbb{D} = \{x \,/\, x = \frac{a}{10^n} \text{ ; where } a \in \mathbb{Z} \text{ and } n \in \mathbb{Z}\}$$

$$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{D}$$

4) Rational numbers:

$$\mathbb{Q} = \{x \,/\, x = \frac{a}{b} \text{ ; where } a \in \mathbb{Z} \text{ and } b \in \mathbb{Z}\}$$

$$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{D} \subset \mathbb{Q}$$

5) Irrational numbers:

It can't be expressed as $\frac{a}{b}$

π ; $\sqrt{2}$; $\sqrt{5}$; $\frac{\pi - 7}{3}$; $\frac{\sqrt{2}-\sqrt{5}}{\sqrt{3}}$ ...

6) Real number.

All numbers.

$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{D} \subset \mathbb{Q} \subset \mathbb{R}$

Remark:

1) $\mathbb{N}^*$; $\mathbb{Z}^*$; $\mathbb{D}^*$; $\mathbb{Q}^*$ and $\mathbb{R}^*$

$\Downarrow$

$\mathbb{N}$; $\mathbb{Z}$; $\mathbb{D}$; $\mathbb{Q}$ and $\mathbb{R}$ without zero.

2) $\mathbb{Z}^+$; $\mathbb{D}^+$; $\mathbb{Q}^+$ and $\mathbb{R}^+$

$\Downarrow$ ~~$\mathbb{N}$~~ $\mathbb{Z}$; $\mathbb{D}$; $\mathbb{Q}$ and $\mathbb{R}$ only +ve.

3) $\mathbb{Z}^-$; $\mathbb{D}^-$; $\mathbb{Q}^-$ and $\mathbb{R}^-$

$\Downarrow$ $\mathbb{Z}$; $\mathbb{D}$; $\mathbb{Q}$ and $\mathbb{R}$ only -ve