

- **N:** Natural numbers (e.g., 1, 2, 3, ...).
- **Z:** Integers (e.g., ..., -3, -2, -1, 0, 1, 2, 3, ...).
- **Q:** Rational numbers (e.g., fractions like  $1/2$ ,  $-3/4$ ,  $7/5$ , ...).
- **R:** Real numbers (e.g., integers, fractions, decimals, and irrational numbers).

Now, instead of writing “x is a natural number”, we write “ $x \in \mathbb{N}$ ” so therefore  $A = \{x \mid x \text{ is a natural number that is a multiple of } 3\}$  becomes  $A = \{x \mid x \in \mathbb{N} \text{ and } x \text{ is a multiple of } 3\}$

#### Set-Builder Notation

Write the following in set-builder notation  $A = \{a, e, i, o, u\}$

Answer:  $A = \{x \mid x \text{ is an English vowel}\}$

(Q)  $E = \{2, 4, 8, 16, \dots\}$

Answer:  $E = \{x \mid x \in \mathbb{N} \text{ and } x = 2^y, y \in \mathbb{N}, y > 0\}$

- **Equal sets** - Two sets are equal sets if and only if they contain the same elements and order doesn't matter and quantity doesn't matter. For ex  $A = \{1, 2, 2, 3, 4, 5\}$  is equal set to set  $B = \{1, 2, 3, 3, 4, 5\}$
- **Equivalent sets** - two sets are equivalent if they contain the same number of distinct elements. Ex-set  $A = \{a, e, i, o, u\}$  is equivalent to  $\{1, 2, 3, 4, 5\}$  because both contain 5 different elements
- **Subset** - The set A is a subset of the set B, denoted  $A \subseteq B$ , if and only if every element in A is also in B
- **Empty or Null set** - The set consisting of no elements is called the empty, or null, set, denoted by the symbol  $\emptyset$  or the empty braces  $\{\}$ . null set is a subset of every set.

(Q) List the subset of  $\{4, 6, 7\} = \{4\}, \{6\}, \{7\}, \{4, 6\}, \{4, 7\}, \{6, 7\}, \{4, 6, 7\}, \{\}$

subsets =  $2^n$  where n is the number of elements in the set.

- **proper subset** - The set A is a proper subset of the set B, denoted  $A \subset B$ , if and only if  $A \subseteq B$  and  $B \neq A$ .  $2^n - 1$  is the equation to find no of proper subset.

- **Universal subset** - The universal set U is the set of all items under consideration.

**Simple statement** – a sentence that is either true or false. eg: It is snowing outside.

**Compound statements** are combination of simple statements by the use of connectives. (and/or/not)  
**connectives**- The three basic connectives we will consider are conjunction (“and”), disjunction (“or”), and negation (“not”)

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we generally start with the letter p, q, and r. For conjunction (“and”), we'll use the symbol  $\wedge$ , for disjunction (“or”), we'll use the symbol  $\vee$ , and for negation (“not”), we'll use the symbol  $\sim$ .

**When we use conjunction in a compound statement, the compound statement is true only if both simple statements are true whereas, when we use disjunction in a compound statement, the compound statement is true if one (or both) of the simple statements is true.**

A **negation** simply turns a statement into its opposite meaning.

p: Sleep is good for you.  $\sim p$ : Sleep is not good for you.

NAND is "Not AND". It is the negation of a conjunction.  $p \neg q$ .

NOR is "Not OR". It is the negation of a disjunction  $p \neg v q$

EOR is "Exclusive OR". The EOR statement is true whenever exactly one of p or q is true.  $p \_ v q$

Commutative

$$A + B = B + A$$

$$A \bullet B = B \bullet A$$

Assosiative

$$A + (B + C) = (A + B) + C$$

$$A \bullet (B \bullet C) = (A \bullet B) \bullet C$$

Identity

$$A + 0 = A$$

$$A \bullet 1 = A$$

Distributive Properties

$$A \bullet (B + C) = (A \bullet B) + (A \bullet C)$$

$$A + (B \bullet C) = (A + B) \bullet (A + C)$$

compliment

$$A + A' = 1$$

$$A \times A' = 0$$

Idempotent

$$A + A = A$$

$$A \bullet A = A$$

0 and 1 Properites

$$A \bullet 0 = 0$$

$$A + 1 = 1$$