Formulas for set

For any three sets A, B and C
$n(A \cup B) = n(A) + n(B) - n(A \cap B)$
If $A \cap B = \varnothing$, then $n(A \cup B) = n(A) + n(B)$
$n(A - B) + n(A \cap B) = n(A)$
$n(B - A) + n(A \cap B) = n(B)$
$n(A - B) + n(A \cap B) + n(B - A) = n(A \cup B)$
$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$

Properties of Sets

Commutative Property : $A \cup B = B \cup A$ $A \cap B = B \cap A$
Associative Property : $A \cup (B \cup C) = (A \cup B) \cup C$ $A \cap (B \cap C) = (A \cap B) \cap C$
Distributive Property : $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
De morgan's Law : Law of union : $(A \cup B)' = A' \cap B'$ Law of intersection : $(A \cap B)' = A' \cup B'$
Complement Law : $A \cup A' = A' \cup A = U$ $A \cap A' = \varnothing$
Idempotent Law And Law of a null and universal set : For any finite set A

$A \cup A = A$ $A \cap A = A$ $\varnothing' = U$ $\varnothing = U'$

These are the basic set of formulas from the set theory.
If there are two sets P and Q,
$n(P \cup Q)$ represents the number of elements present in one of the sets P or Q.
$n(P \cap Q)$ represents the number of elements present in both the sets P & Q.
$n(P \cup Q) = n(P) + (n(Q) - n(P \cap Q)$
For three sets P, Q, and R,
$n(P \cup Q \cup R)=n(P)+n(Q)+n(R)-n(P\cap Q)-n(Q\cap R)-n(R\cap P)+n(P\cap Q\cap R)$

Symbol	Symbol Name	Meaning	Example
{ }	set	a collection of elements	A = {1, 7, 9, 13, 15, 23}, B = {7, 13, 15, 21}
$A \cup B$	union	Elements that belong to set A or set B	$A \cup B$ = {1, 7, 9, 13, 15, 21, 23}
$A \cap B$	intersection	Elements that belong to both the sets, A and B	$A \cap B$ = {7, 13, 15 }
$A \subseteq B$	subset	subset has few or all elements equal to the set	{7, 15} $\subseteq$ {7, 13, 15, 21}
$A \not\subset B$	not subset	left set is not a subset of right set	{1, 23}

			⊄ B
A ⊂ B	proper subset / strict subset	subset has fewer elements than the set	{7, 13, 15} ⊂ {1, 7, 9, 13, 15, 23}
A ⊃ B	proper superset / strict superset	set A has more elements than set B	{1, 7, 9, 13, 15, 23} ⊃ {7, 13, 15, }
A ⊇ B	superset	set A has more elements or equal to the set B	{1, 7, 9, 13, 15, 23} ⊃ {7, 13, 15, 21}
Ø	empty set	Ø = { }	C = {Ø}
P (C)	power set	all subsets of C	C = {4,7}, P(C) = {{}, {4}, {7}, {4,7}} Given by 2s, s is number of elements in set C
A ⊅ B	not superset	set X is not a superset of set Y	{1, 2, 5} ⊅ {1, 6}
A = B	equality	both sets have the same members	{7, 13,15} = {7, 13, 15}
A \ B	relative	objects that belong to A and not to	{1, 9,

or A-B	complement	B	23}
Ac	complement	all the objects that do not belong to set A	We know, U = {1, 2, 7, 9, 13, 15, 21, 23, 28, 30} Ac = {2, 21, 28, 30}
A Δ B	symmetric difference	objects that belong to A or B but not to their intersection	A Δ B = {1, 9, 21, 23}
a∈B	element of	set membership	B = {7, 13, 15, 21}, 13 ∈ B
(a,b)	ordered pair	collection of 2 elements	(1, 2)
x∉ A	not element of	no set membership	A = {1, 7, 8, 13, 15, 23}, 5 ∉ A
|B|, #B	cardinality	the number of elements of set B	B = {7, 13, 15, 21}, |B|=4
A×B	cartesian product	set of all ordered pairs from A and B	{3,5} × {7,8} = {(3,7), (3,8), (5,7), (5, 8) }
N1	natural numbers / whole	N1 = {1, 2, 3, 4, 5,…}	6 ∈ N1

	numbers set (without zero)		
N0	natural numbers / whole numbers set (with zero)	N0 = {0, 1, 2, 3, 4,…}	0 ∈ N0
Q	rational numbers set	Q= {x | x=a/b, a, b∈Z}	2/6 ∈ Q
Z	integer numbers set	Z= {…-3, -2, -1, 0, 1, 2, 3,…}	-6 ∈ Z
C	complex numbers set	C= {z | z=a+bi, -∞<a<∞, -∞<b<∞}	6+2i ∈ C
R	real numbers set	R= {x | -∞ < x <∞}	6.343434 ∈ R

Properties of Union of Sets	Properties of Intersection of sets
A ∪ B = B ∪ A (Commutative law)	A ∩ B = B ∩ A (Commutative law)
A ∪ B) ∪ C = A ∪ (B ∪ C) (Associative law)	(A ∩ B) ∩ C = A ∩ (B ∩ C) (Associative law)
A ∪ φ = A (Law of identity element, φ is the identity of ∪)	φ ∩ A = φ, U ∩ A = A (Law of φ and U)
A ∪ A = A (Idempotent law)	A ∩ A = A (Idempotent law)
U ∪ A = U (Law of U)	A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C) (Distributive law)

Properties of Complement of set:
$A \cup A' = U$
$A \cap A' = \varphi$
$(A \cup B)' = A' \cap B'$
$(A \cap B)' = A' \cup B'$
$U' = \varphi$
$\varphi' = U$

Properties of the intersection of sets operation:
$A \cap B = B \cap A$
$(A \cap B) \cap C = A \cap (B \cap C)$
$\varphi \cap A = \varphi$; $U \cap A = A$
$A \cap A = A$
$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

Some properties of Union operation:
$A \cup B = B \cup A$
$(A \cup B) \cup C = A \cup (B \cup C)$
$A \cup \varphi = A$
$A \cup A = A$
$U \cup A = U$

Properties of Complement sets
$P \cup P' = U$
$P \cap P' = \Phi$
Law of double complement : $(P')' = P$
Laws of empty/null set(Φ) and universal set(U), $\Phi' = U$ and $U' = \Phi$.

Cartesian Product of sets
If set A and set B are two sets then the cartesian product of set A and set B is a set of all ordered pairs (a,b), such that a is an element of A and b is an element of B. It is denoted by $A \times B$.
We can represent it in set-builder form, such as:
$A \times B = \{(a, b) : a \in A \text{ and } b \in B\}$
Example: set $A = \{1,2,3\}$ and set $B = \{\text{Bat, Ball}\}$, then;
$A \times B = \{(1,\text{Bat}),(1,\text{Ball}),(2,\text{Bat}),(2,\text{Ball}),(3,\text{Bat}),(3,\text{Ball})\}$

Difference of Sets

If set A and set B are two sets, then set A difference set B is a set which has elements of A but no elements of B. It is denoted as A – B.

Example: A = {1,2,3} and B = {2,3,4}

A – B = {1}

Links that mentioned in the videos :-

Introduction of set :- https://youtu.be/Q985NC7B5fs

Types of set reference :- https://youtu.be/crQ97zTdS8s

Operations on set :- https://youtu.be/IV47aiFpffk
https://youtu.be/TZIIUWbkIwM

Laws of set theory :- https://youtu.be/I8WdCozPTeQ
https://youtu.be/HGBLmzHIxJU

Word problem :- https://youtu.be/pJ3ed3YCHr4
https://youtu.be/CRnh3Vb5BdY

Example : - https://youtu.be/Ry2tvyat3Y4
https://youtu.be/YSpEA1Cv5VQ

Other links from nptel :- https://youtu.be/ISVco9sY-SQ
https://youtu.be/je-HLcRBWuM
https://youtu.be/rh-Ew15RO04
https://youtu.be/wHW-n-friXA
https://youtu.be/JbUFP3txIus
https://youtu.be/nwiuF5hV_5U
https://youtu.be/71P8JoowR-8
https://youtu.be/OBLAbeRvaFE
https://youtu.be/FF8_CQDABk8
https://youtu.be/FNTdU1Iphg0
https://youtu.be/fk0taIB2uhw

Other youtube links:- https://youtu.be/YGXMc8sNBYo
https://youtu.be/byCqdYDDNns
https://youtu.be/6RsudHXe6ZM
https://youtu.be/10Bg_-GYi1c
https://youtu.be/B3L8ZzrZwzA

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