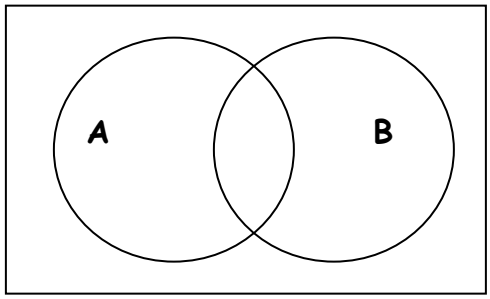
T101 SECTION 2.3 OTHER SET OPERATIONS AND THEIR PROPERTIES

A. Set Intersection: The intersection of two sets A and B, denoted _____, is the set of all elements **common to both** A and B.

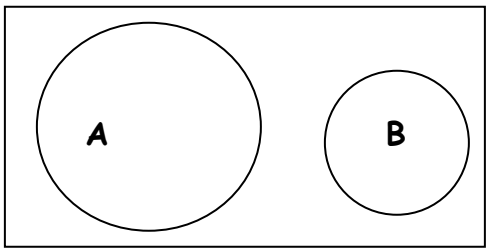
Venn Diagram:

Note: $\mathbf{A} \cap \mathbf{B} = \{x \mid x \in A \text{ and } x \in B\}$



B. Disjoint Sets: Two sets that have **no elements** in common; that is $\mathbf{A} \cap \mathbf{B}$ would be the empty set.

Venn Diagram:



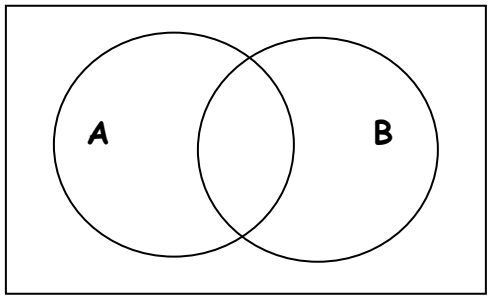
Can you think of two sets that are disjoint?

Two infinite sets that are disjoint?

C. Set Union: The union of two sets A and B, denoted _____, is the set of **all elements in A or B.**

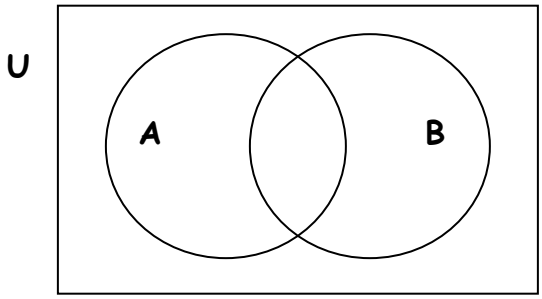
Venn Diagram:

Note: $\mathbf{A} \cup \mathbf{B} = \{x \mid x \in A \text{ or } x \in B\}$



D. **Set Difference:** The difference of two sets **B** and **A**, denoted _____,
Complement of A relative to B: is the set of **all elements in B that are not in A.**

Venn Diagram:

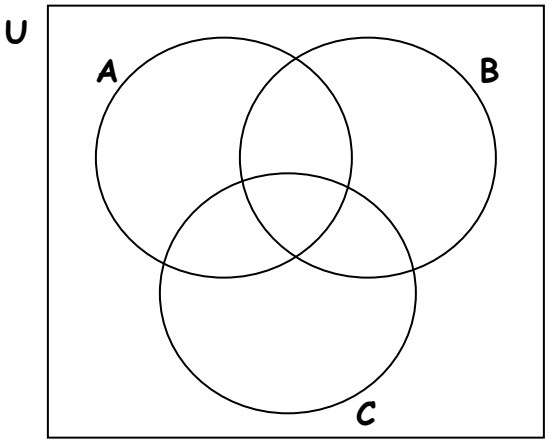


Note: **B – A** = {x | x ∈ B and x ∉ A}

E. **EXAMPLES:** Given the universal set U = {u,n,i,v,e,r,s,a,l} A = {s,i,l,v,e,r}

B = {l,a,n,e} C = {s,i,r}

Draw a Venn Diagram:



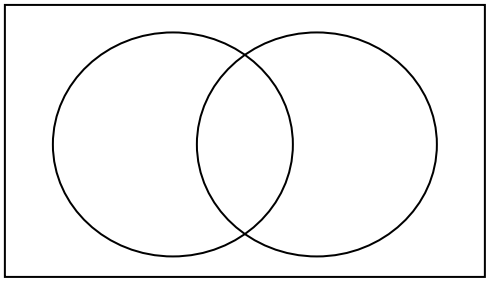
Find the following:

A U B B U C A ∩ B

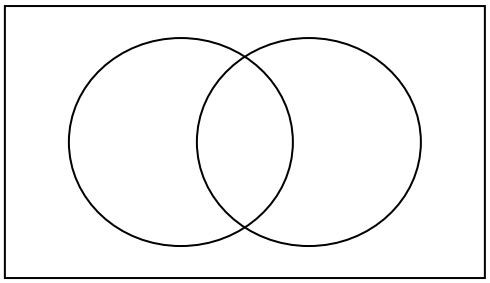
A ∩ C B – A A – B

B ∩ C n (A ∩ C) n (B ∩ C)

If n(U) = 100, n(A) = 40, n(B) = 50, and n(A ∩ B) = 15, then draw a Venn diagram showing the cardinal number of each section of the diagram.



In a fraternity with 60 members, 35 take math, 10 take both math and biology, and 16 take neither math nor biology. How many take biology, but not math?



F. Properties of Set Operations

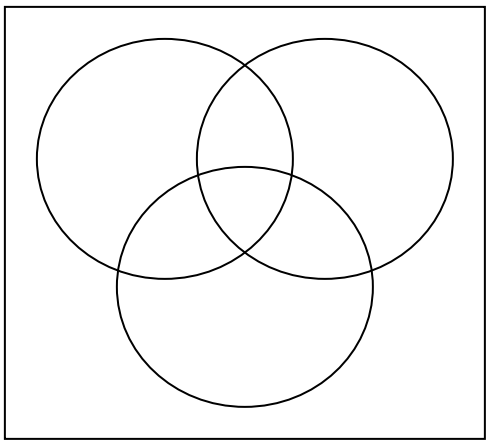
Commutative Property of Set Union **A U B = B U A**
Commutative Property of Set Intersection **A ∩ B = B ∩ A**

Associative Property of Set Union **A U (B U C) = (A U B) U C**
Associative Property of Set Intersection **A ∩ (B ∩ C) = (A ∩ B) ∩ C**

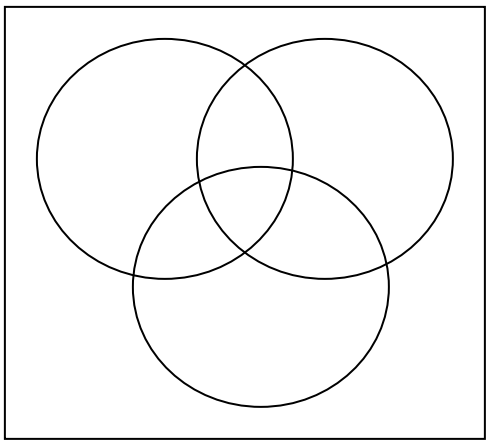
Distributive Property of Set Intersection over Union **A ∩ (B U C) = (A ∩ B) U (A ∩ C)**

Illustrate the Distributive Property of Set Intersection over Union using Venn Diagrams

A ∩ (B U C)



(A ∩ B) U (A ∩ C)



G. Cartesian Product

Another way to produce a set from two given sets is by forming the **Cartesian product.** This type of set is formed by pairing the elements of one set with the elements of another set in a specific way.

For any sets A and B, the **Cartesian product of A and B**, denoted _____, is the set **of all <u>ordered pairs</u>** such that the first component of each pair is an element of A and the second component of each pair is an element of B. **$A \times B = \{ (x, y) \mid x \in A \text{ and } y \in B\}$**

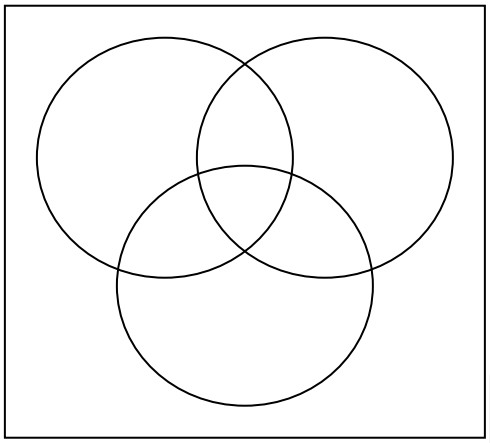
If A = {x, y, z} and B = {O, Δ}, find:

A x B B x A A x A

A survey of 80 sophomores at IUS showed that:

36 take English 32 take History 32 take Math
16 take History & English 16 take Math & History 14 take Math &English
6 take all three

a. How many students take English and neither of the other two?
b. How many students take none of the three courses?
c. How many students take History and neither of the other two?
d. How many students take Math & History, but not English?
e. How many students do not take Math?



Answers: a. 12 b. 20
c. 6 d. 10 e. 48