Math 3201 **Date:**_____

1.3 Intersection and Union of Two Sets

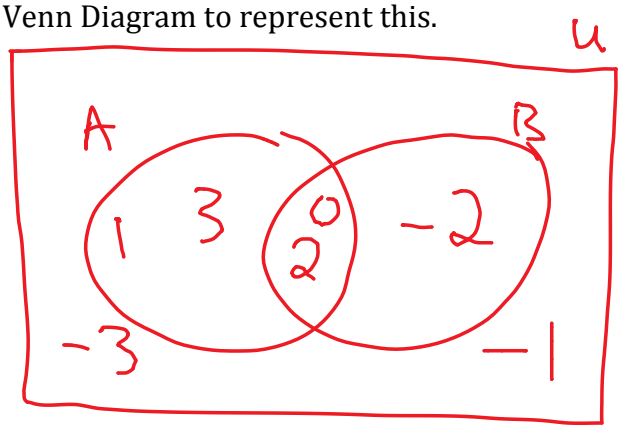
Consider a universal set of integers from −3 to 3. Set A is the set of non-negative integers and set B is the set of integers divisible by 2.

$U = \{-3, -2, -1, 0, 1, 2, 3\}$

$A = \{0, 1, 2, 3\}$

$B = \{-2, 0, 2\}$

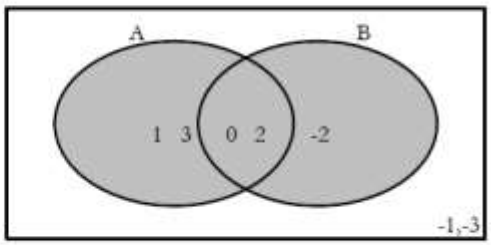
Draw a Venn Diagram to represent this.



We will examine the union and intersection of sets on this Venn Diagram.

Union of Sets (OR)

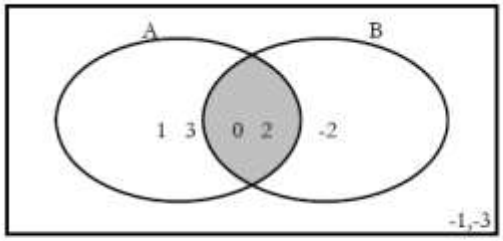
- This represents all of the elements that are in one set OR the other set OR in the overlap between the sets.
- It is often indicated using the word "or".
- The symbol for union is ∪.

Set Notation	Meaning	Venn Diagram	Answer
$A \cup B$ (A union B)	any element that is in either of the sets		{-2, 0, 1, 2, 3}

A ∪ B represents elements in set A **OR** set B **OR** in the overlap.

Intersection of Sets (AND)

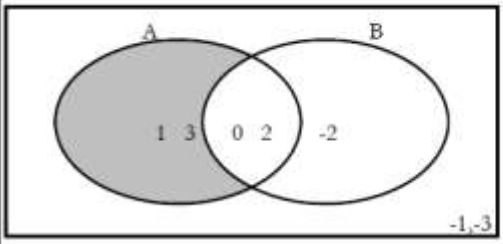
- This represents all of the elements that are in the overlap between the sets.
- It is often indicated using the word "and".
- The symbol for intersection is ∩.

A ⋂ B (A intersect B)	only elements that are in both A and B		{0,2}

A ∩ B represents the elements in the overlap between Sets A and B. That is, it represents elements included in both Set A **and** Set B.

The Minus of Sets (NOT)

- This represents all of the elements that are in one set but not the other.
- It is often indicated using the word "**not**".
- The symbol for minus is \ .

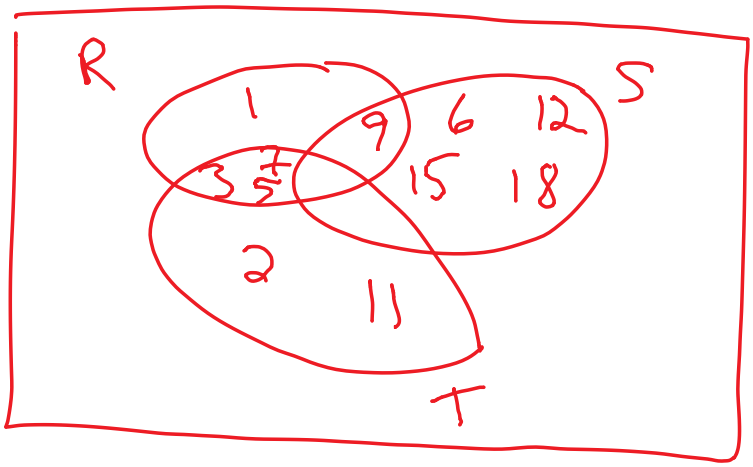
A\B set A minus set B	elements found in set A but excluding the ones that are also in set B		{1,3}

A\B represents the elements in the Set A but **NOT** in Set B.

Example 1:
R is the set of positive odd numbers less than 10. S is the set of multiples of 3 between 4 and 20. T is the set of prime numbers less than 12. Create a Venn Diagram illustrating these sets.

$R = \{1, 3, 5, 7, 9\}$ $T = \{2, 3, 5, 7, 11\}$

$S = \{6, 9, 12, 15, 18\}$



union

(A) List the elements of R ∪ S.

$R \cup S = \{1, 3, 5, 6, 7, 9, 12, 15, 18\}$

intersection

(B) List the elements of R ∩ S.

$R \cap S = \{9\}$

(C) What does it mean to write $x \in (R \cap T)$? List all possible values of x.

x must be common to R and T

$R \cap T = \{3, 5, 7\}$

(D) Is it true that S ∩ T is the empty set? Explain.

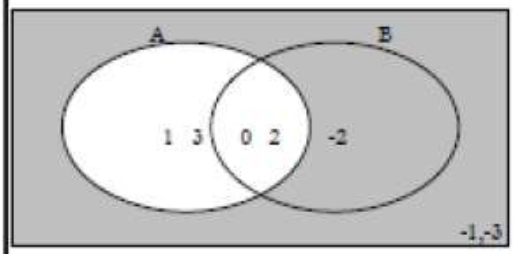
Yes. There are no elements in the intersection of S and T.

Complements on Venn Diagrams
Recall the example that we looked at earlier on a Venn Diagram. Consider a universal set of integers from 3 to 3. Set A is the set of non-negative integers and set B is the set of integers divisible by 2.

Here we will look at the complement or elements NOT included in some of the sets we examined earlier. ie. union, intersection and minus sets.

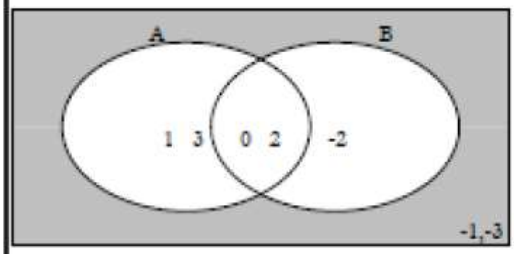
Complement of a Set

- This includes any element that is NOT in the set.
- The complement of set A can be written in two ways: A' or not A

Set Notation	Meaning	Venn Diagram	Answer
A' (A complement or not A)	all elements in the universal set outside of A		{-3, -2, -1}

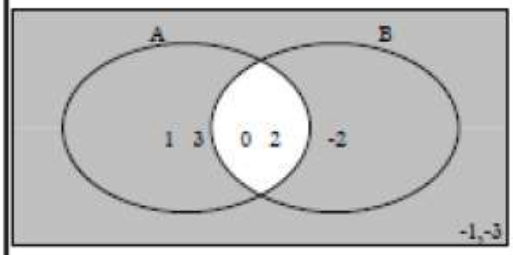
Complement of a Union of Sets

- This includes any element outside the union of sets. Recall that a union of sets refers to elements in either of the sets **OR** elements in the overlap of sets.
- Recall that the unions of sets A and B is written as A ∪ B. The complement of the union of sets A and B can be written in two ways: (A ∪ B)' and not (A union B).

Set Notation	Meaning	Venn Diagram	Answer
$(A \cup B)'$ not (A union B)	elements outside A and B		{-3, -1}

Complement of an Intersection of Sets

- This includes any element outside the intersection of sets. Recall that an intersection of sets refers to elements in the overlap of sets.
- Recall that the intersection of sets A and B is written as A ∩ B. The complement of the intersection of sets A and B can be written in two ways: (A ∩ B)' and not (A intersect B).

Set Notation	Meaning	Venn Diagram	Answer
$(A \cap B)'$ not (A intersect B)	elements outside of the overlap of A and B		{-3, -2, -1, 1, 3}

Example 2:
The diagrams below represent the activities chosen by youth club members. They can choose to play tennis (T), baseball (B) or swimming (S). Decide which diagram has the shading which represents the following descriptions:

i. Those who play all three sports. A

ii. Those who play tennis and baseball, but not swimming. C

iii. Those who play only tennis. B

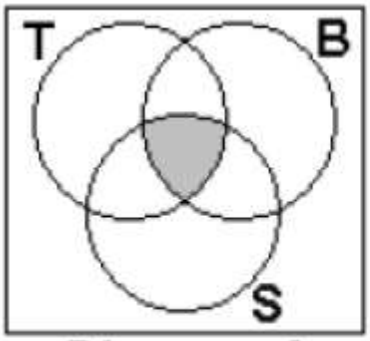


Diagram A

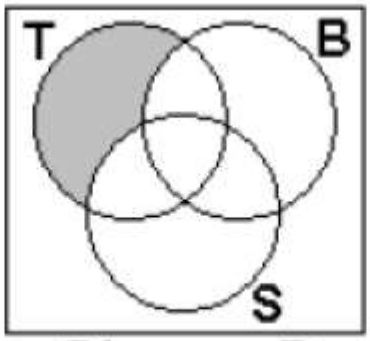


Diagram B

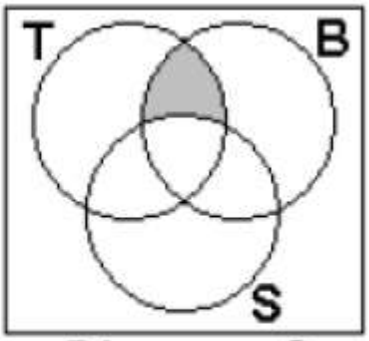


Diagram C

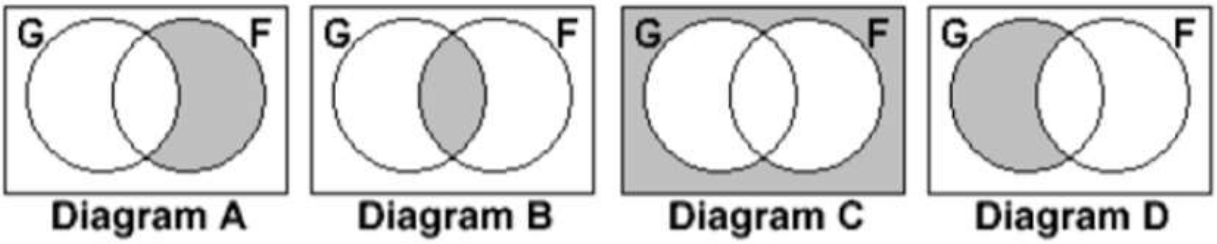
Example 3:
The diagrams below represent a class of children. G is the set of girls and F is the set of children who like fencing. Decide which diagram has the shading which represents:

i. girls who like fencing B

ii. girls who dislike fencing D

iii. boys who like fencing A

iv. boys who dislike fencing C



Question
On this handout, we have used the words "and", "or" and "not" to describe links between various sets. There are many applications of these logical operators. Some people use them when conducting Internet searches on a topic. Explain how they be useful when conducting web searches.

And, Or aut not or "—" can be used to filter or narrow down results in a search engine.

Textbook Questions: page 20, #1, 2, 3, 4, 5