Set Operations and the Venn Diagram

Lesson 2

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The Integers

$\{\ldots,-3,-2,-1, 0, 1, 2, 3,\ldots\}$

Includes:

All negative whole numbers

Zero

All positive whole numbers

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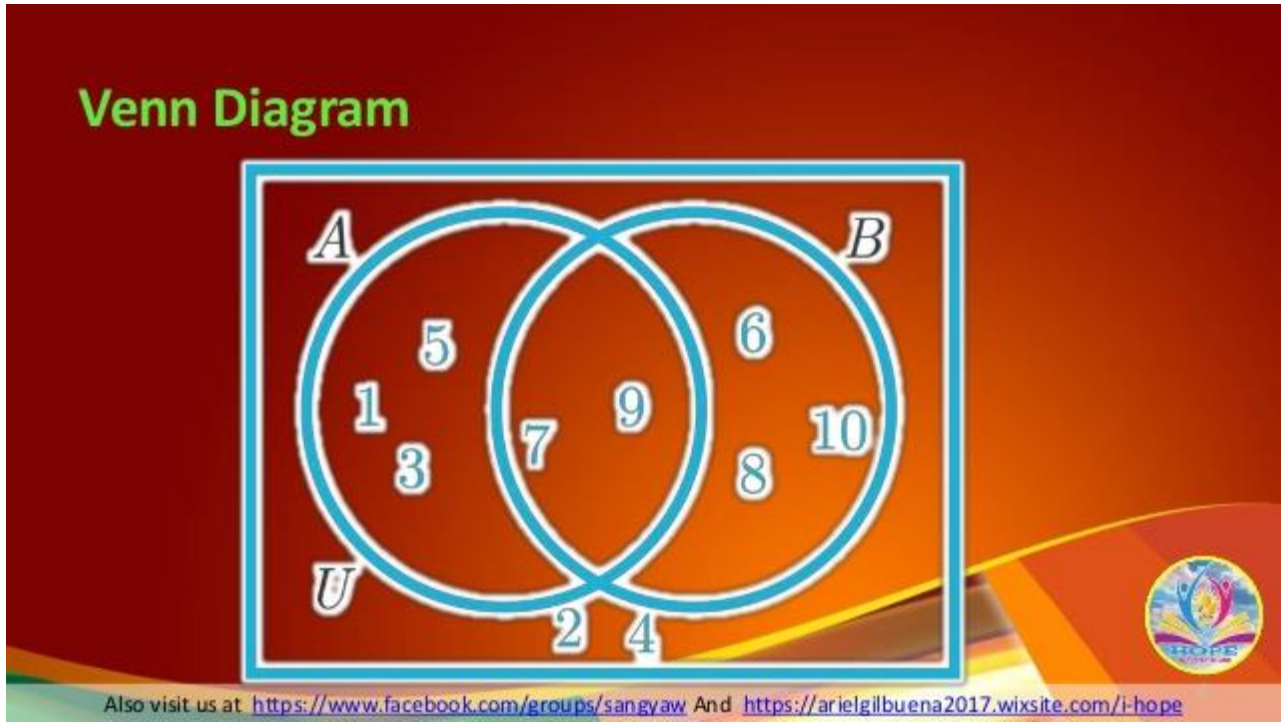
Objectives

At the end of this lesson, you should be able to:

- perform set operations like union, intersection, complement and difference; and
- use a Venn diagram to illustrate set operations

Learn about it!

- A **Venn diagram** is used to represent relationships between a collection of objects or sets.
- As shown below, a Venn diagram usually has a rectangle with circles inside. The rectangle represents the universal set and the circles inside represent the different subsets in the universal set. The letter name of the set is written beside it.


Venn Diagram
A
B
U
1
3
5
7
9
6
8
10
2
4
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- In the illustration, the universal set contains natural numbers from 1 to 10, or

  U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
- Set A = 1, 3, 5, 7, 9}
- Set B = { 6, 7, 8, 9, 10}
- Notice that 2 and 4 are outside the circles that represent sets A and B. This means that both numbers are **not** elements of either A or B.

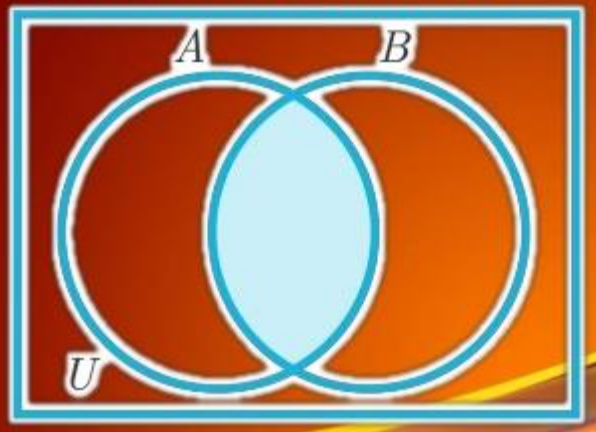
- There are four basic set operations that are best understood using Venn diagrams. These are **union intersection**, **complement**and **difference**.

Set Operations

- Given two sets *A* and *B*:
- **Union** *(∪)* – *A* ∪ *B* is the set that contains all the elements in either *A* or *B*.

Set Operation

Intersection (∩) – $A \cap B$ is the set that contains all common elements between sets A and B.



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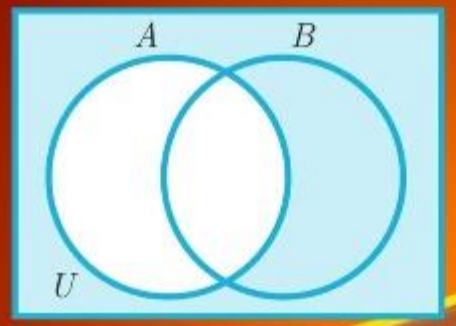
Set Operation

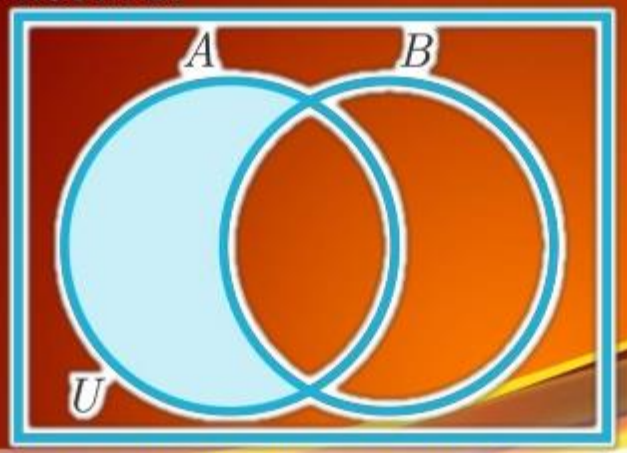
Complement (')

A' is the set that contains all elements in the universal set that are not in set A.



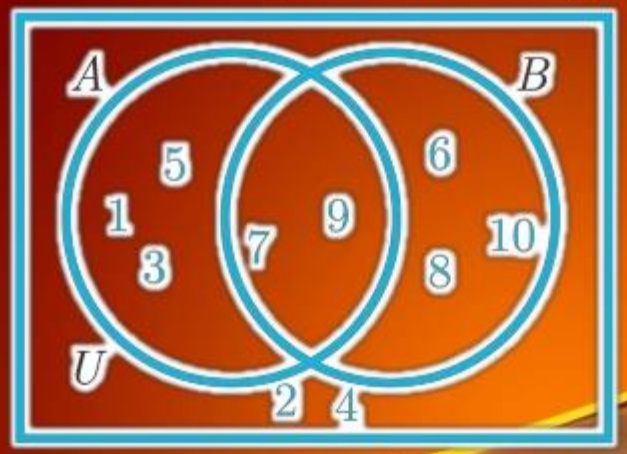
Set Operation

Difference (-) – *A* - *B* is the set that contains all elements of *A* that are not in *B*.

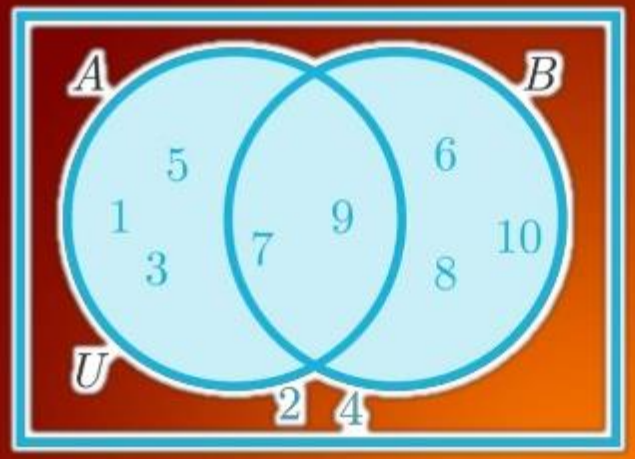


Example

- Consider the Venn diagram from the previous chapter.



Find $A \cup B$



$A \cup B = \{1, 3, 5, 6, 7, 8, 9, 10\}$

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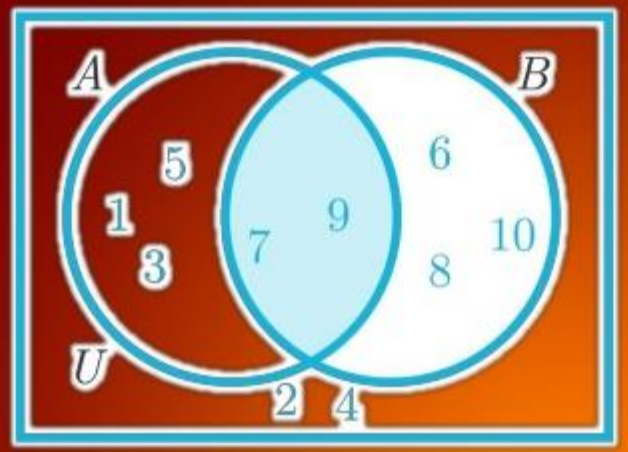
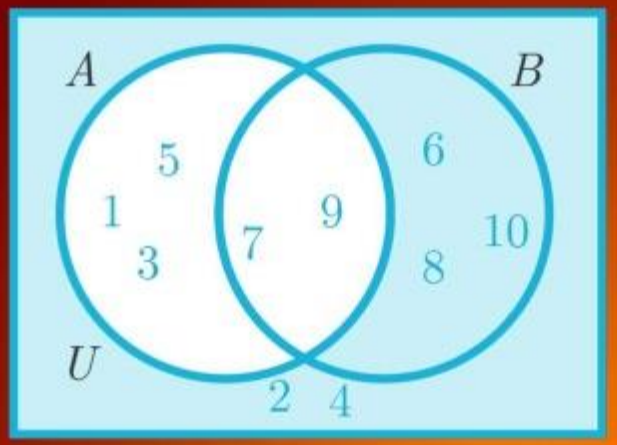
Find $A \cap B$



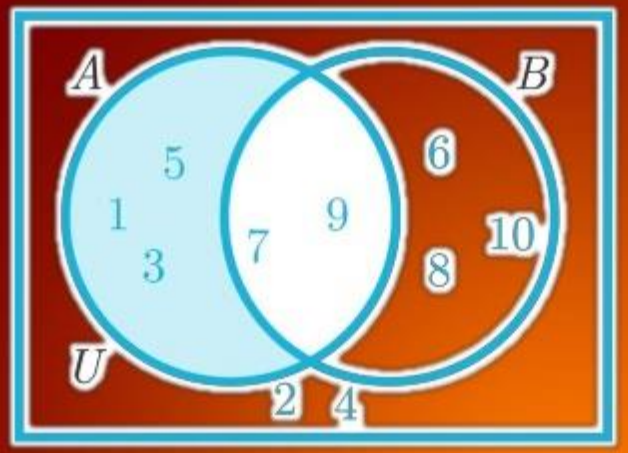
$A \cap B = \{7, 9\}$

Find A'



$A' = \{2, 4, 6, 8, 10\}$

Find *A* - *B*



$A' = \{1, 3, 5\}$

Try it!

Illustrate the given sets *A* and *B* using a Venn diagram and perform the following operations:

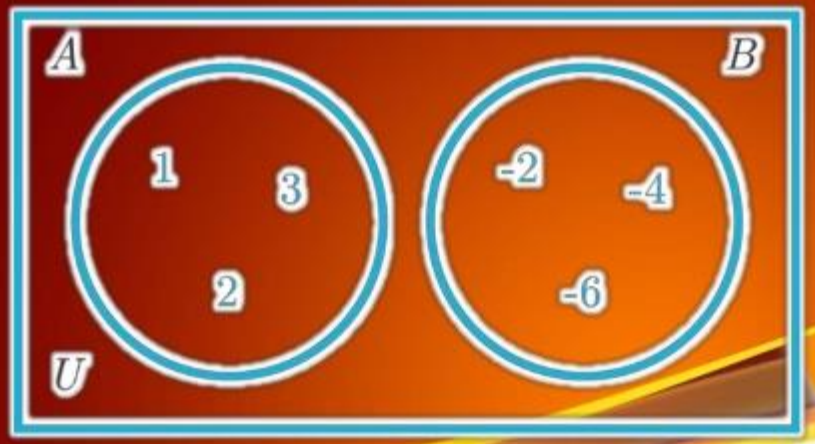
$A = \{1, 2, 3\}$

$B = \{-6, -4, -2\}$

1. $A \cup B$
2. $A \cap B$
3. B'
4. $A - B$

Try it Solution

$A = \{1, 2, 3\}$ and $B = \{-6, -4, -2\}$ can be illustrated as:



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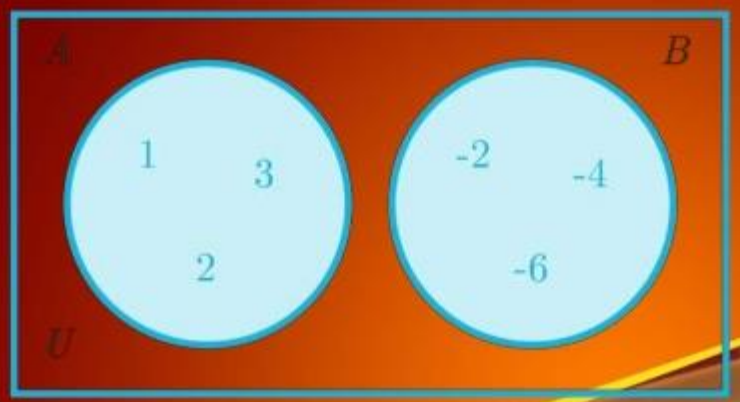
Try it Solution

1. $A \cup B = \{-6, -4, -2, 1, 2, 3\}$

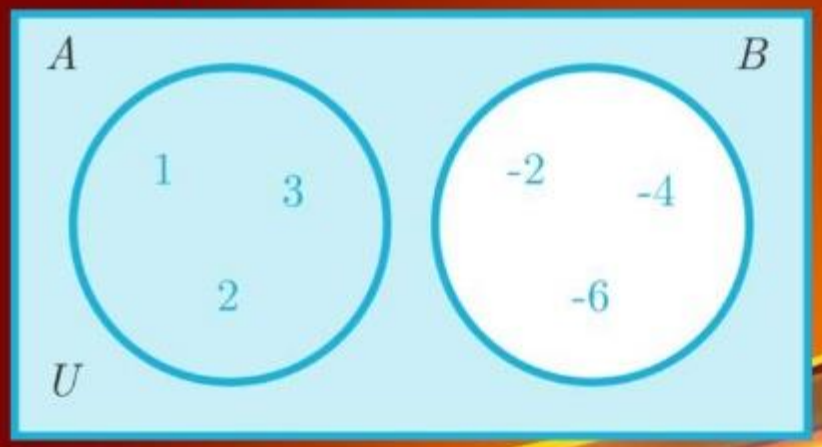


Try it Solution

2. $A \cap B = \{\}$ or $\emptyset$

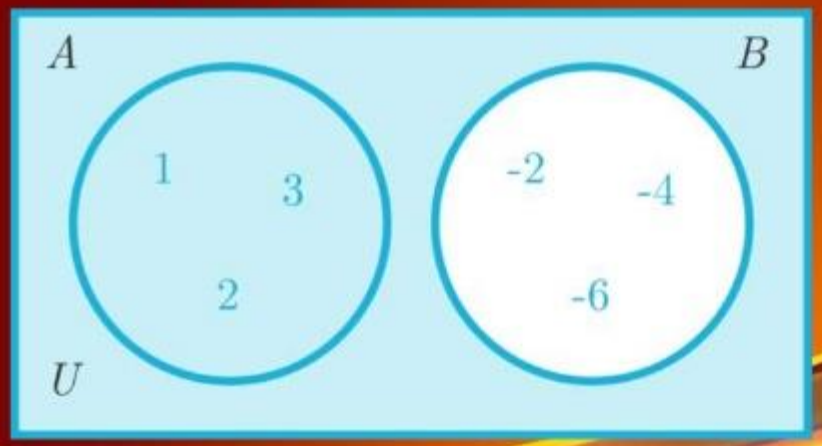
Try it Solution

2. B′ = {1, 2, 3}



Try it Solution

2. A - B = {1, 2, 3}



Question 5

Given the following Venn diagram, what is B – A?
Select your answer.

a) {1, 3, 5, 6}
b) {2, 4, 9, 10, 11}
c) {2, 4}
d) {1, 2, 3, 4, 5, 6}