

Section C.1: Sets and Venn DiagramsDefinition of a set

A *set* is a collection of objects and its objects are called *members*.

|| **Ex.1** Days of the week.

|| **Ex.2** Students in this class.

|| **Ex.3** Letters of the alphabet.

Venn diagrams *Venn diagrams* are pictures that describe the relationships between sets. Circles represent sets.

|| **Ex.4** The set of “students.”

|| Ex.5 All the students in this class are students.

We say that the students in this class," as a set, is a subset of the set "students."

|| Ex.6 If we consider the sets "dogs" and "cats," then there is not a member which is both a dog and a cat.

We say that "dogs" and "cats" are disjoint sets.

|| Ex.7 Consider the sets "men" and "students."

We say that "men" and "students" are overlapping sets.

Types of Venn diagrams for two sets

The Venn diagrams for two sets A and B are of three types:

(a) A is a *subset* of B , which means that all the members of A are members of B .

(b) A is *disjoint* from B , which means that A and B does not have any member in common.

(c) A and B are *overlapping* sets, which means that they (may) share some of the members.

Ex.8 Numbers.

- Set of *natural numbers*:

- Set of *whole numbers*:

- Set of *integers*:

- Set of *rational numbers*:

the rational numbers are of the form $\frac{x}{y}$, where x and y are integers and $y \neq 0$.

For example, $\frac{1}{2}$, $\frac{3}{5}$, $\frac{9}{4}$.

When expressed in decimal forms, rational numbers are either terminating decimals with a finite number of digits (for example, $\frac{1}{4} = 0.25$) or repeating decimals in which a pattern repeats over and over (for example, $\frac{1}{3} = 0.333\dots = 0.\bar{3}$).

- Set of *irrational numbers*:

the irrational numbers are numbers that cannot be expressed in the form $\frac{x}{y}$, where x and y are integers and $y \neq 0$. When written as decimals, irrational numbers neither terminate nor have a repeating pattern.

For example, π , $\sqrt{2}$:

$$\pi = 3.14159\dots, \quad \sqrt{2} = 1.4142\dots$$

- Set of *real numbers*:

the set of real numbers consists of both rational and irrational numbers.

The Venn diagram representing the relationship between these sets of numbers is:

Section C.2: Categorical Propositions**Definition of a proposition**

A *proposition* is a sentence that makes a claim.

Ex.9 Examples of propositions:

- It is raining today.
- All basketball players are tall.
- All whales are mammals.
- Dolphin is a fish.

Definition of a categorical proposition

A *categorical proposition* is a proposition which claims a particular relationship between two categories or sets.

Types of categorical propositions

There are four types of categorical propositions:

(a) All whales are mammals.

(b) No fish are mammals.

(c) Some doctors are women.

(d) Some teachers are not men.

If a categorical proposition is not in the standard form like “Some birds can fly,” we can change it as follows:
“Some birds are animals that can fly.”

|| **Ex.10** How can we change “Elephants never forget” into the standard form?

|| **Ex.11** How can we change “Every nurse knows CPR” into the standard form?

Section C.3: Venn Diagrams with Three Sets

|| **Ex.12** Students at the U.

Consider the students at the U and the sentences:

- Some of the honor-student boys are unemployed.
- Some of the non-honor-student girls are employed.

|| How can we draw a picture representing this situation?

|| **Ex.13** Problem 53.

|| Draw the Venn diagram for these sets: women, dentists, kindergarten teachers.

|| Ex.14 Problem 55.

|| Draw the Venn diagram for these sets: published works, novels, songs.

Section C.4: More Uses of Venn Diagrams**Ex.15** Application of Venn diagrams.

Consider the two-way table:

		Baby's Birth Weight Status	
		Low Birth Weight	Normal Birth Weight
Mother's Smoking Status	Smoker	18	132
	Nonsmoker	14	186

We can use a Venn diagram to represent the situation:

Ex.16 Problem 59: A Venn diagram with numbers.

- (1) How many women at the party are under 30?
- (2) How many men at the party are not under 30?
- (3) How many women are at the party?
- (4) How many people are at the party?

Ex.17 Problem 77: Completing a two-way table.

A survey of 120 patrons at a restaurant gave the following preferences for entrees and drinks. (Fill in the missing figures in the table and make a Venn diagram to represent the data.)

	Vegetarian	Meat/fish	Total
Wine	20		60
No Wine		15	
Total			120

Ex.18

Of the 100 students in the Science Club, 40 are taking a physics class, 42 are taking a chemistry class, and 15 are taking a math class. Moreover, 30 students are taking chemistry only, 24 students are taking physics only, 6 students are taking math only, 5 students are taking physics and math only, 8 students are taking physics and chemistry only. Draw a Venn diagram to illustrate this information. Use the symbol P , C , M to represent the set of physics, chemistry, and math students respectively.

Use your diagram to answer the following:

- (1) How many students are taking all three subjects?
- (2) How many students in the Science Club are not taking any of these three subjects?