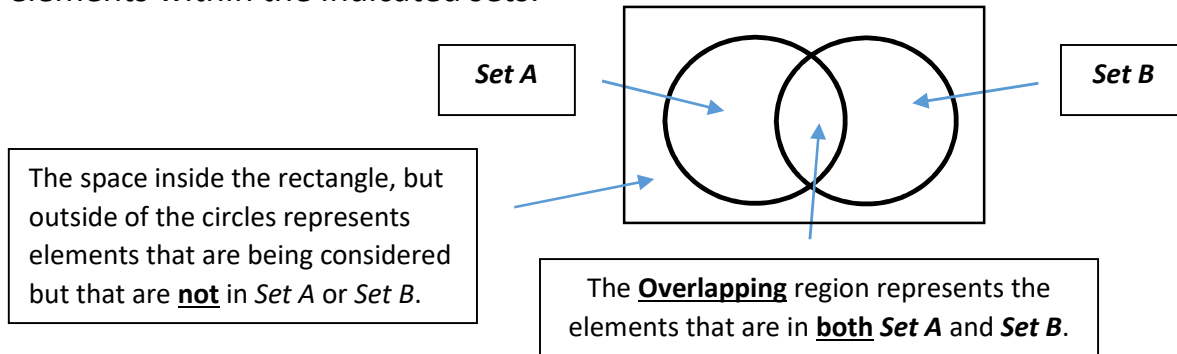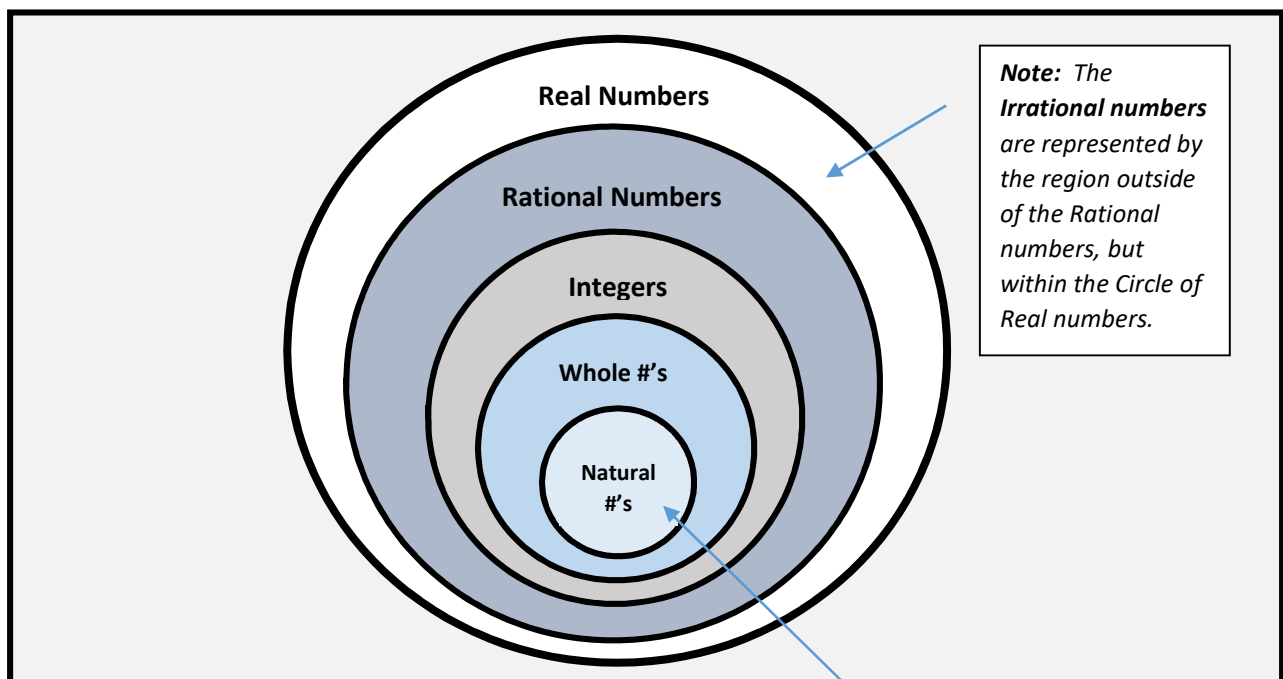# Venn Diagrams

Venn Diagram – A tool developed by the English logician John Venn to visually organize and display the relationships among sets.

Venn diagrams typically use overlapping circles to illustrate the logical relationships between two or more sets of items. The circles are enclosed by a rectangle that can also represent some definition or characteristic. The sizes of the resulting regions in the Venn diagram do *not* represent the quantities associated with the number of elements within the indicated sets.

Set A

Set B

The space inside the rectangle, but outside of the circles represents elements that are being considered but that are **not** in *Set A* or *Set B*.

The **Overlapping** region represents the elements that are in **both** *Set A* and *Set B*.

Example -
The Venn Diagram below represents the relationship between categories of numbers.

Real Numbers

Rational Numbers

Integers

Whole #'s

Natural #'s

*Note: The **Irrational numbers** are represented by the region outside of the Rational numbers, but within the Circle of Real numbers.*

Natural #'s are a subset of Whole #'s.
Whole #'s are a subset of Integers.
Integers are a subset of Rational #'s.
Rational #'s are a subset of Real #'s.

Note: If a set is a subset of another set, then the entire circle representing the subset is drawn *inside* of the circle representing the larger set. This is a *nested circle* instead of an overlapping circle.

Venn diagrams are particularly helpful when analyzing *three or more sets* that may overlap each other. Drawing a Venn diagram can help to organize the information which can be given in table or paragraph form. Once organized, it can be easier to answer questions about the sets, particularly if the data associated with the number of members in the sets or overlapping regions is given.

Note*: If the information is given in paragraph form, it may be helpful to create a table before constructing the Venn Diagram.*

Example - All runners who competed in a marathon were given a drug test after the race. Of the 20 who <u>tested positive</u>, 5 finished in the <u>top 10</u>. 40 runners <u>tested negative</u>.

a. Summarize the data in a table.

b. Draw a Venn Diagram from the data given in the paragraph.

c. Answer the following questions.

    i. How many runners who tested negative did not finish in the top 10?

    ii. How many runners competed in the marathon?

> **Note: Any calculated information in the table is shown in red font.**

a. Table

	Drug Test Results		
Position	**Positive**	**Negative**	*Total*
Top 10 Finish	5	5	*10*
Non-Top 10 Finish	15	35	*50*
Total	*20*	*40*	*60*

b. Venn Diagram
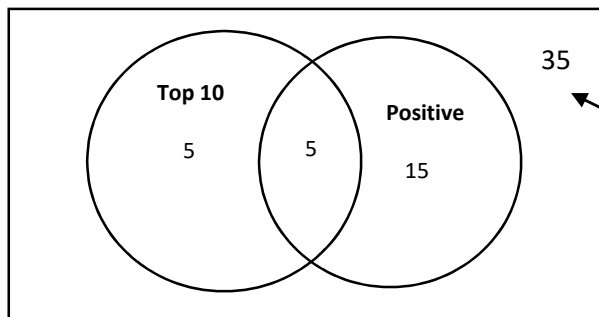
c. i. 35 runners

    ii. 60 runners

35

Top 10

5   5

Positive

15

> This space represents the runners that neither finished in the Top 10 or tested positive.

2

Example – A recent survey of 150 college students revealed the following data on the number of students who used smart phones, tablets, and/or laptops
(*Data source: Pew Research Center*) –

Smart Phone, Tablet, and Laptop Usage Data				
Note: Sometimes this information is not given, but instead needs to be **calculated** based on a given total.	Smart Phone ONLY	51	Smart Phone AND Tablet ONLY	35
	Tablet ONLY	8	Smart Phone AND Laptop ONLY	37
	Laptop ONLY	12	Tablet AND Laptop ONLY	4
	No Devices	2	All three Devices	1

a. Draw a Venn Diagram to represent the data in the table.

b. Answer the following questions about the data set.

i. How many students used *at least* a smartphone?

ii. How many students used a tablet *or* a laptop?

iii. How many students used a smart phone *and* a laptop, but *not* a tablet?

iv. How many students used a smart phone *or* a laptop, but *not* a tablet?
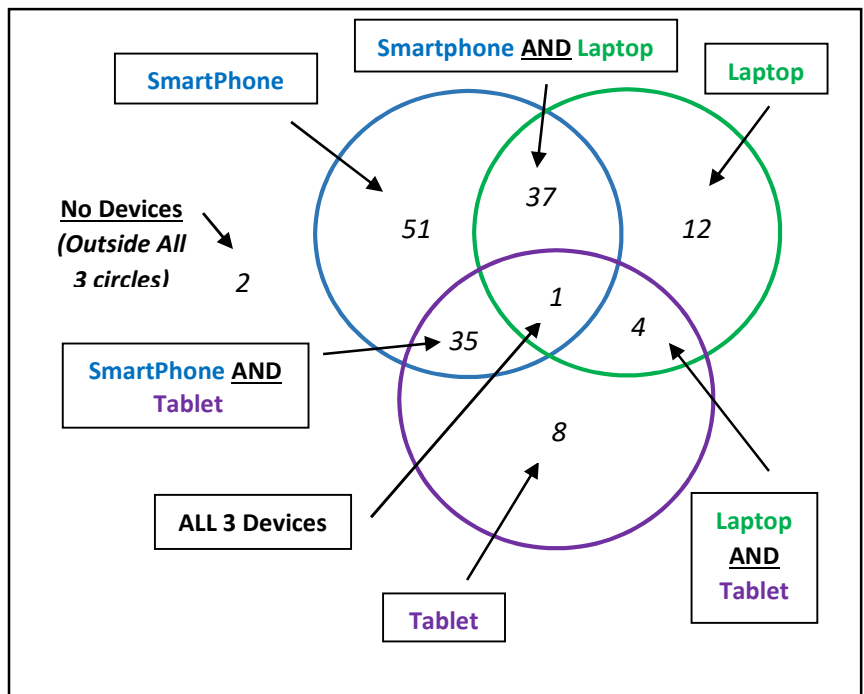
v. How many students used *exactly two* devices?

Step 1: Draw 3 circles to represent the 3 categories. Label ALL 8 regions.

Step 2: Fill in the given data.

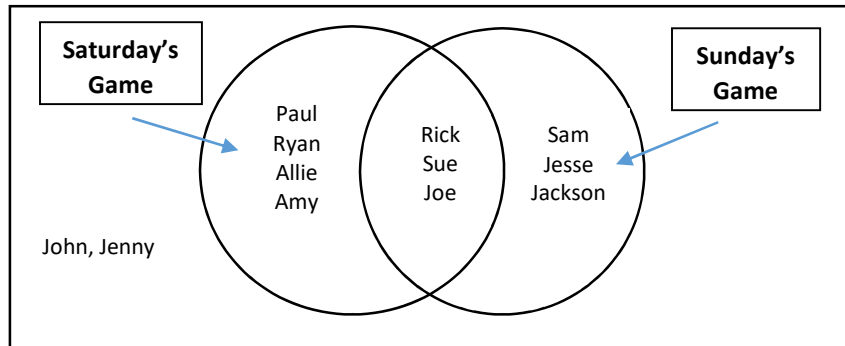*Step 3:* Compute any missing data. *(None for this example.)*

Step 4: Answer questions.
   i. = 51+37+1+35 = **124**
   ii. = 150 – 51 – 2 = **97**
   iii. = **37**
   iv. = 37+51+12 = **100**
   v. = 37+4+35 = **76**

Try these on your own!

1. Consider the Venn Diagram below which represents attendance at the weekend baseball games and answer the following questions.
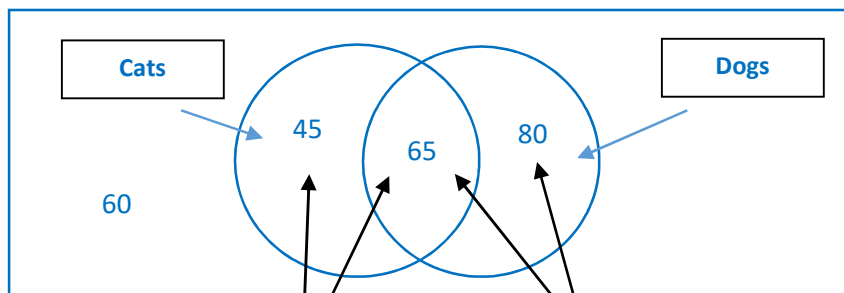

a. Who attended the game on Saturday? *(Paul, Ryan, Allie, Amy, Rick, Sue, Joe)*
b. Who attended the game on Sunday? *(Sam, Jesse, Jackson, Rick, Sue, Joe)*
c. Who attended both the Saturday and Sunday games? *(Rick, Sue, Joe)*
d. Who did not attend either game? *(John, Jenny)*

2. Given the information below, construct a data table, a Venn diagram, and answer the following questions.

A pet store surveyed 250 people. Of those, 110 owned a cat and 145 owned a dog. 65 owned both a cat and a dog.

a. How many owned just a cat? *(110 – 65 = **45**)*
b. How many owned just a dog? *(145 – 65 = **80**)*
c. How many did not own a cat or a dog? *(250 – 45 – 80 – 65 = **60**)*

The total of ALL numbers inside the rectangle must be 250.

Must total 110

Must total 145