

# Set theory

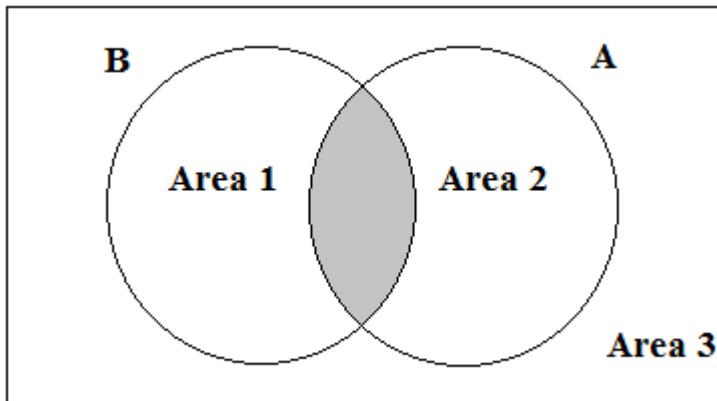
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Set theory is important both from a mathematical point of view as well as a reasoning point of view. You will see a lot of questions based on set theory in a lot of aptitude exams. Set theory questions have two ways of solving.

1. Formula approach.
2. Venn Diagram approach.

## Two attributes situation:

Let's have a situation where two attributes A and B. A refers to those people who passed Physics and B refers to those people who passed Chemistry.



The rectangular box represents a universal set.

**Area 1:** People who passed only Physics.

**Area 2:** People who passed only Chemistry.

**Area 3:** People who passed neither Physics nor Chemistry.

**Formula:**  $A \cup B = A + B - A \cap B$ .

### Problem 1:

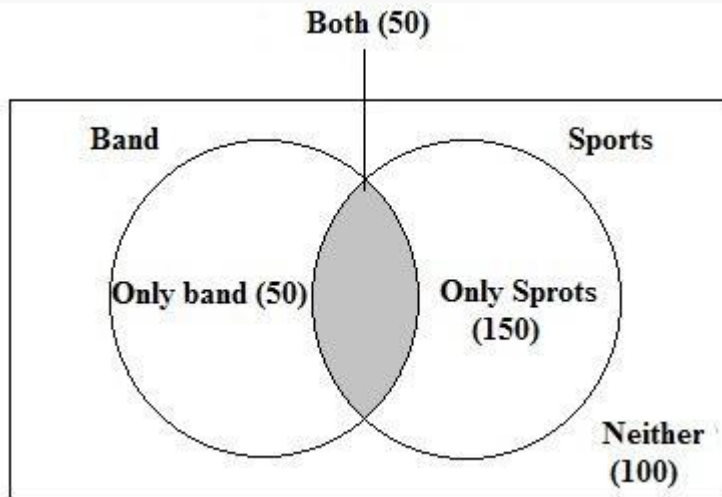
In a school of 350 students, 100 are in the Band, 200 are in the Sports team and 50 are in both Band and Sports team.

1. How many students are involved neither in Band nor in Sports?
2. How many people involved at least one of the two?
3. What is the ratio of people who participate only in the band to only in sports?

**Solution:**

50 students are in both Band and Sports. So,  $100 - 50 = 50$  students are in Band only and  $200 - 50 = 150$  students are in Sports only.

Total students 350 and  $350 - 250 = 100$  students are neither in Band nor in Sports.



1. Students are involved neither in Band nor in Sports = 100.
2. Students involved at least one of the two =  $50 + 50 + 150 = 250$ .
3. Students only in Band = 50 and students only in Sports = 150  
Hence, the Ratio of students only in the band to only in sports =  $50:150 = 1:3$ .

### Problem 2:

There are 60 students in a class, 60% fail in English and 30% pass in Maths and 20% pass in both English and Maths. How many students fail in either of 2 subjects or at least in one subject?

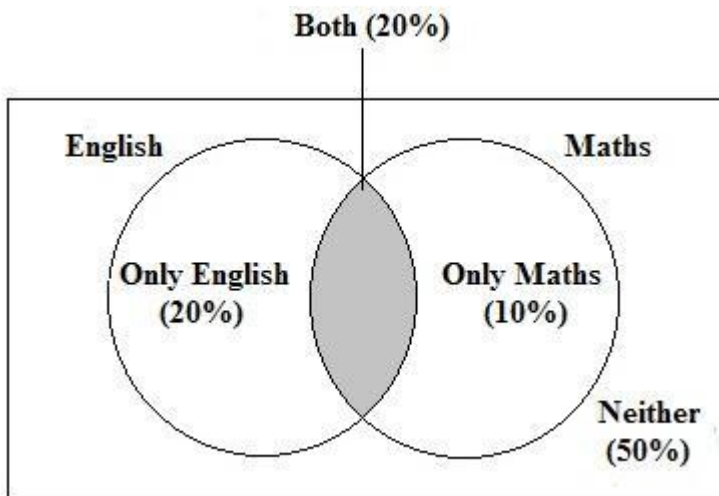
### Solution:

20% of students pass in both English and Maths. So,  $30\% - 20\% = 10\%$  of students pass in maths only and 60% fail in english means 40% pass in english and  $40\% - 20\% = 20\%$  of students pass in English only.

Total students 100% and  $100 - 50 = 50\%$  of students neither pass in english nor pass in maths.

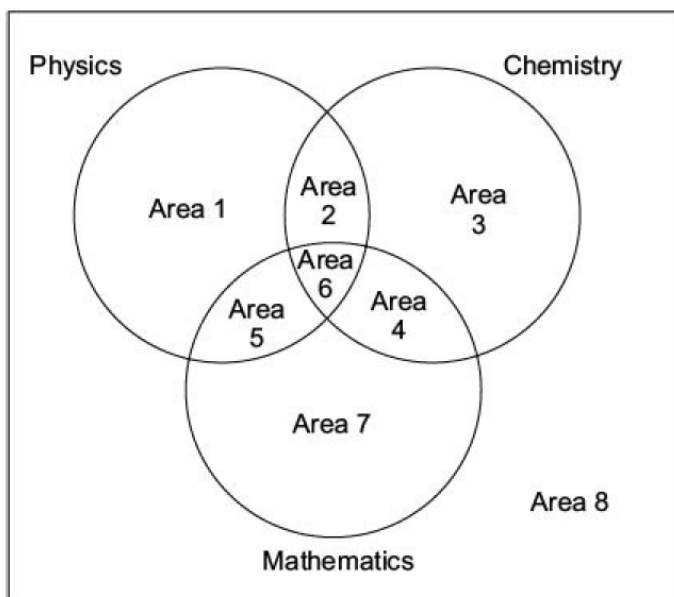
Number of students fail in either of two subjects =  $20\% + 10\% = 30\%$  i.e 30% of 60 = 18 students.

Number of students fail in at least one subject =  $20 + 10 + 50 = 80\%$  i.e 80% of 60 = 48 students.



### Three attributes situation:

Let's have a situation where there are three attributes being measured. Suppose we are talking about people who passed Physics, Chemistry and Mathematics.



**Area 1:** People who passed in Physics only

**Area 2:** People who passed Physics and Chemistry but not Maths.

**Area 3:** People who passed Chemistry only

**Area 4:** People who passed Chemistry and Maths but not physics.

**Area 5:** People who passed Physics and Maths but not in Chemistry.

**Area 6:** People who passed Physics, Chemistry and Maths

**Area 7:** People who passed Maths only

**Area 8:** People who passed in no subjects.

People passing Physics and Chemistry: Represented by the sum of areas 2 and 6

People passing Physics and Maths: Represented by the sum of areas 5 and 6

People passing Chemistry and Maths: Represented by the sum of areas 4 and 6

People passing Physics: Represented by the sum of the areas 1, 2, 5 and 6

People passing at least 2 subjects = area 6 + area 2/4/5

People passing exactly 2 subjects: represented by area 2,4 and 5.

### Problem 1:

A veterinary doctor surveyed 52 people. He discovered that 28 have dogs, 20 have cats and 10 have parrots, 8 have dogs and cats, 6 have dogs and parrots and 2 have cats and parrots. No one has all three pets.

1. How many people have only a dog?
2. How many people have at least 2 pets among dogs, cats and parrots?
3. How many people have none of the 3 pets?

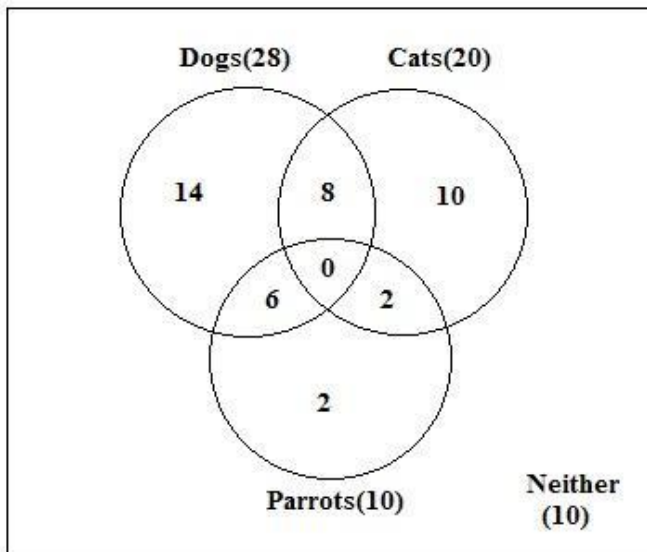
### Solution:

8 people have dogs and cats, 6 people have dogs and parrots.  $28 - (8+6) = 14$  people have only dogs.

8 people have dogs and cats, 2 people have cats and parrots.  $20 - (8+2) = 10$  people have only cats.

6 people have dogs and parrots, 2 people have cats and parrots.  $10 - (6+2) = 2$  people have only parrots.

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1. People have only a dog = 14.
2. People have at least 2 pets =  $6+8+2= 16$ .
3. People have none of the 3 pets = 10.