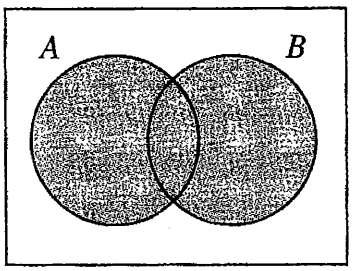
VENN DIAGRAMS

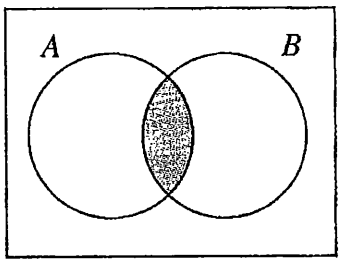
When a group can be categorized into a number of different subgroups and a single selection is made from the group, we can represent the sample space using a VENN DIAGRAM.



$A \cup B$

Union – this is the sum of sets A and B.

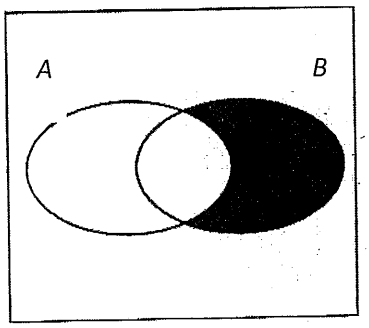
The set A ∪ B can be described as the elements in A **OR** in B (**OR** in both)



$A \cap B$

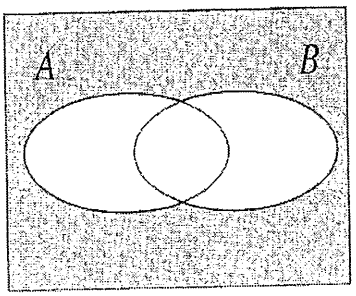
Intersection – this is where sets A and B overlap.

The set A ∩ B can be described as the elements in A **AND** in B



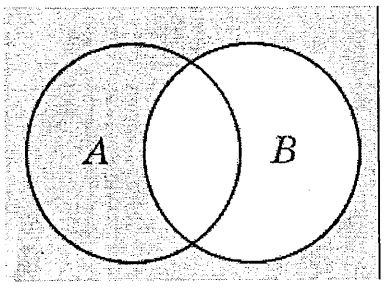
A ′∩ B

This set can be described as the elements **not** in A **and** in B.



A′∩ B′

This set can be described as the elements **not** in A **and not** in B.



B' This set can be describes as the elements not in B

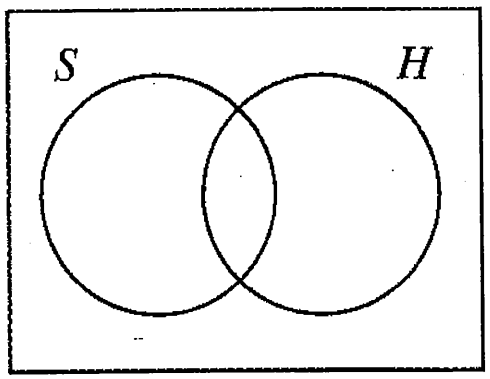
EXAMPLE:

In a group of 50 students, 32 are wearing sunglasses and 29 are wearing hats. There are 4 students who are wearing neither. Let S = "wearing sunglasses", and let H = "wearing a hat".

a. Display this information in a Venn Diagram.
b. Find the probability that a randomly selected student:
   i. Is wearing both sunglasses and a hat
   ii. Is wearing sunglasses and no hat

SOLUTION:

a. Create the Venn Diagram with two overlapping circles



b. i. Wearing both sunglasses **and** a hat. $Pr(S \cap H) =$

ii. Wearing sunglasses **and** not a hat $Pr(S \cap H') =$

iii. Wearing a hat **and** no sunglasses

EXAMPLE: A radio station conducts an internet survey to determine what styles of music people want to listen to. It was possible to select more than one style of music. Of a group of 100 listeners:

- 50 people selected Rap
- 39 people selected Indie
- 32 people selected Pop
- 9 people selected all three
- 20 people selected Rap and Indie
- 11 people selected Pop and Indie
- 18 people selected only Pop

a. Create a Venn Diagram to illustrate this information

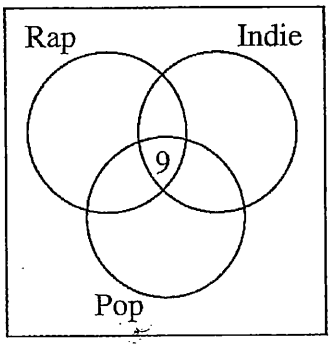
b. Use your Venn Diagram to find:

i. The probability that a randomly selected listener chose exactly two styles of music.

ii. The probability that a randomly selected listener selected only one style of music

iii. The probability that a randomly selected listener selected Rap or Pop or both.

SOLUTION: Draw three overlapping circles. In the intersection common to all three, put 9. Then fill in the other regions according to the information.



a exactly two styles of music Pr(exactly two)

b only one style of music Pr(one style)

c Rap or Pop Pr(Rap or Pop)