

$$P(A \cup B) = P\left(\frac{A}{B}\right) + P\left(\frac{B}{A}\right) - P(A \cap B)$$

We must subtract the overlapping outcomes so that we don't "double count" any outcome that satisfies both events.

Converting this idea to probability notation we get:

$$P(\text{either } A \text{ or } B) = P(A) + P(B) - P(\text{both } A \text{ and } B)$$

OR

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

OR

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

In words, this is read as "the probability of event A or B occurring is equal to the probability of event A added to the probability of event B minus the probability of event A and B occurring simultaneously.

If you can see the sample space for an experiment, just be sure to NOT count any outcome more than once. (Refer again to Example 1c) on the previous page.)

If you cannot see the sample space, or create it easily, you must determine if two events are mutually exclusive (or not) before adding their respective probabilities.

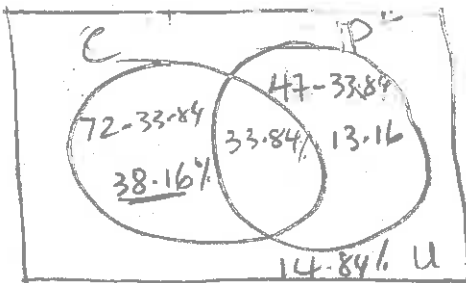
Example 2 (again):

The probability of a person living in Winnipeg having a library card is 72%. The probability of a person living in Winnipeg owning a pet is 47%. Determine the probability of a randomly selected Winnipegger having a library card or owning a pet.

- a) How many *selections* are being performed in this experiment?: 2
- b) What are the two events for this experiment?: library card & pet owners
- c) Are these two events *mutually exclusive*, or *not mutually exclusive*? Justify your answer.
Not mutually exclusive because you can own a library card and own pets.
- d) How can you determine the probability that a randomly selected Winnipegger has a library card AND owns a pet? AND → add the probabilities
$$\frac{72}{100} \times \frac{47}{100} = 0.3384 \rightarrow \times 100 = 33.84\%$$

$$P(\text{card}) \times P(\text{pet}) =$$
- e) Use a Venn diagram to determine the probability that a randomly selected Winnipegger has a library card or owns a pet.

U = {TOTAL Winnipeggers}
C = {library card}
P = {owns pet}



$$100 - 85.16 = 14.84\%$$

$$100 - 38.16 - 33.84 - 13.16 = 14.84\%$$