

## Probability: OR

### Summary

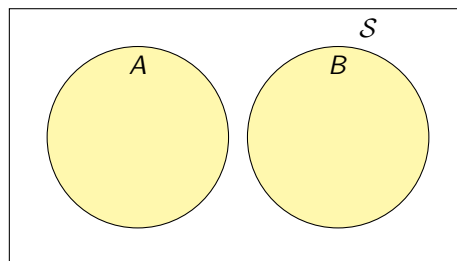
1. In probability, the word *or* implies addition.
2. If two events can occur simultaneously (*and*), we have to subtract it from our count.
3. Probability something does *not* happen =  $1 - \text{probability it does happen}$
4. Odds are calculated using the complement rule.

### Addition Rule

**Example 1.** A fair die is rolled. What is the probability of rolling a 4 or a 5?

To find the OR probability of two mutually exclusive events, use the Addition Rule:

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



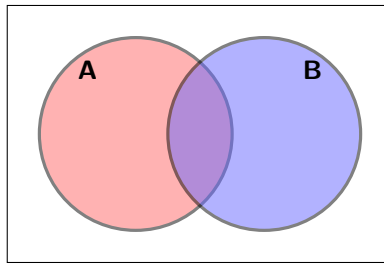
**Example 2.** The table below lists the types and numbers of cars sold at Lemon Autos along with their ages. Find each probability.

	0–2	3–5	6–10	Over 10	Total
Import	37	21	12	30	100
Domestic	35	23	11	31	100
Total	72	44	23	61	200

(a) If a car is randomly selected, what is the probability that the car is 0–2 years old or over 10 years old?

(b) If a car is randomly selected, what is the probability that the car is 3–5 years old or a domestic car?

## General Addition Rule



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

Venn Diagram of Example 2b:

**Example 3.** A card is drawn at random from a standard deck of cards. Find each probability.

(a) Selecting a 3 or a club

(b) Drawing a face card or a red card

## Complement Rule

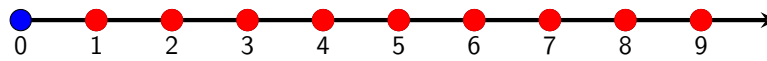
### Complements

The **complement** of an event is the probability the event does *not* happen.

Event:  $P(A)$

Complement:  $P(A')$

## “At Least One” Probabilities



- *At least one* means 1 or 2 or 3 or 4 or ...
- The complement of *at least one* is **none**.
- In general, the complement of *at least  $n$  events* is  **$n - 1$  events or less**.

**Example 4.** Two dice are rolled. What is the probability of rolling a sum of at least 4?

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

**Example 5.** A certain blood test can determine the presence of a bloodborne pathogen 97% of the time. If 4 people with the pathogen are given the test, find the probability that the test is accurate for at least one of them.

## Odds

For events  $A$  and  $A'$ :

### Odds in Favor

The **odds in favor** of event  $A$  to happen are  $\frac{A}{A'}$ , or  $A : A'$

### Odds Against

The **odds against** event  $A$  to happen are  $\frac{A'}{A}$ , or  $A' : A$

*Note:* Typically when odds are listed, they are the odds against.

**Example 6.** The probability that the Cleveland Browns win the Super Bowl this year is 20%. What are the odds for and against this?

**Example 7.** A jar contains red and yellow marbles. The odds against selecting a red marble are 5 to 3. What is the probability of selecting a red marble?