

"OR" vs. "AND"

"OR"

one event - choice of outcome

mutually exclusive:

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

inclusive / overlapping:

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

"AND"

more than one event occurs

independent:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

dependent:

$$P(A \text{ and } B) = P(A) \cdot P(B|A)$$

EXAMPLE 1

one event

- You randomly choose a card from a standard deck of 52 playing cards.

Find the probability that you will choose ...

- a) ... a Jack, Queen, or King. (exclusive)

$$P(J) + P(Q) + P(K) = \frac{4}{52} + \frac{4}{52} + \frac{4}{52} = \frac{12}{52} = \boxed{\frac{3}{13}}$$

- b) ... a Jack or a heart. (inclusive)

$$P(J) + P(\heartsuit) - P(J \cap \heartsuit) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52}$$

- c) ... an even number or a club. (inclusive) = $\boxed{\frac{4}{13}}$

$$P(\text{even}) + P(\text{club}) - P(\text{even} \cap \text{club}) = \frac{20}{52} + \frac{13}{52} - \frac{5}{52} = \frac{28}{52} = \boxed{\frac{7}{13}}$$

Compound Events Notes & Examples

EXAMPLE 2

two outcomes

- You roll one number cube twice.

a. Are the events dependent or independent?

- What is the probability that you roll ...

b. ... a 1 and then a 2?

order
is
defined

$$P(1) \cdot P(2) \\ \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

c. ... two even numbers?

$$P(\text{even}) \cdot P(\text{even}) \\ \frac{3}{6} \cdot \frac{3}{6} = \frac{9}{36}$$

d. ... a 1 and a 2?

$$P(1) \cdot P(2) + P(2) \cdot P(1) \\ = \frac{1}{36} + \frac{1}{36} = \frac{2}{36} = \frac{1}{18} = \frac{1}{4}$$

EXAMPLE 3

two events

- A jar contains 4 red marbles and 6 blue marbles. You chose one marble at random, do not replace it, then choose a second marble at random.

a. Are the events dependent or independent?

- What is the probability that you choose ...

b. ... two blue marbles?

$$P(B) \cdot P(B|B) \\ = \frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90} = \frac{1}{3}$$

c. ... one red and one blue?

$$P(R) \cdot P(B|R) + P(B) \cdot P(R|B) \\ = \frac{4}{10} \cdot \frac{6}{9} + \frac{6}{10} \cdot \frac{4}{9} \\ = \frac{24}{90} + \frac{24}{90} = \frac{48}{90} = \frac{8}{15}$$