

Warm - up

1) Thirteen runners are in a cross-country race. How many different ways can they finish first, second, and third?

$${}_{13}P_3 =$$

$$\underline{13} \cdot \underline{12} \cdot \underline{11} =$$

1,716

2) Eleven football players are in a huddle. In how many ways could they be arranged?

$$\frac{11!}{11}$$

3,628,800

Warm - up

3) How many different arrangements of the letters in the word "Probability" are possible?

$$\frac{11!}{2!2!}$$

9,979,200

4) Jeff has to pick 5 friends to go on a camping trip. He decides to pick 2 from his 8 neighborhood friends and 3 from his 7 closest school friends. How many different groups would be possible?

$${}^8C_2 \cdot {}^7C_3 =$$

980

U2: Probability

Basic Probability and Probabilities of Multiple Events

Unit 1 Topics

1) A bag contains 5 yellow, 6 blue and 4 white marbles.

a. What is the probability that a marble selected at random will be yellow?

$$\frac{\text{Described}}{\text{Total}} = \frac{5}{15} \rightarrow \left(\frac{1}{3} \right)$$

b. What is the probability that a marble selected will not be white?

$$\left(\frac{11}{15} \right)$$

Probability for Consecutive Events

Independent Events

Each event does not affect the next one

$$P(A) \times P(B) = P(A \text{ then } B)$$

Probability of flipping heads **then** rolling a 2 on a die?

$$\frac{1}{2} \cdot \frac{1}{6} = \frac{1}{12}$$

Dependent Events

Each event does affect the next one

$$P(A) \times P(B) = P(A \text{ then } B) \quad * \text{Account for Change}$$

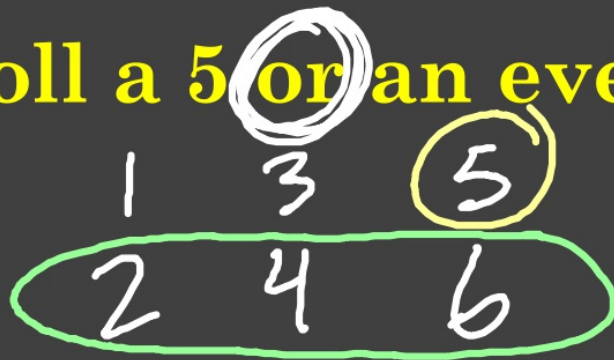
Probability of selecting a red card **then** a blue from a bag with 4 red and 6 blue cards?

$$\frac{4}{10} \cdot \frac{6}{9} = \frac{4}{15}$$

Exclusive Probability

Two outcomes that cannot occur at the same time.

Ex. Roll a 5 or an even number.



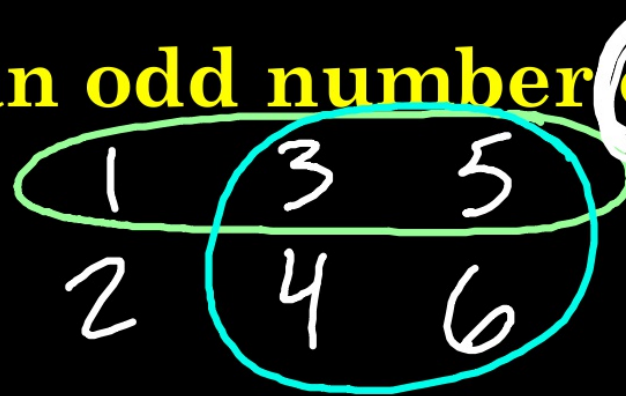
$$P(\text{A or B}) = P(\text{A}) + P(\text{B})$$

$$\frac{1}{6} + \frac{3}{6} = \frac{2}{3}$$

Inclusive Probability

Two outcomes that can occur at the same time.

Ex. Roll an odd number or greater than a 2.



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

$$\frac{3}{6} + \frac{4}{6} - \frac{2}{6} = \frac{5}{6}$$

Overlap

2) A bag contains 5 yellow, 6 blue and 4 white marbles.

a. What is the probability of picking a blue then a yellow?

$$\frac{6}{15} \cdot \frac{5}{14} = \frac{1}{7}$$

b. What is the probability of picking a white then another white, with replacement?

$$\frac{4}{15} \cdot \frac{4}{15} = \frac{16}{225}$$

Example 1:

Kevin has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If he selects a card at random from the stack, what is the probability that it is a baseball **or** a soccer card?

$$\frac{8}{19} + \frac{6}{19} = \frac{14}{19}$$

Example 1:

At a picnic, Julio reaches into a ice-filled cooler containing 8 regular soft drinks and 5 diet soft drinks. He removes a can, then decides he is not really thirsty, and puts it back. What is the probability that Julio and the next person to reach into the cooler both randomly select a regular soft drink?

$$\frac{8}{13} \cdot \frac{8}{13} = \frac{64}{169}$$

Example:

The enrollment at Hickory High School is 1400. Suppose 550 students take French, 700 take Algebra, and 400 take both French and Algebra. What is the probability that a student selected at random takes French or Algebra?

$$\frac{550}{1400} + \frac{700}{1400} - \frac{400}{1400} = \frac{850}{1400}$$

↓

$$\frac{17}{28}$$

Example 2:

In a board game, three dice are rolled to determine the number of moves for the players. What is the probability that the first die shows a 6, the second die shows a 6, and the third die does not?

$$\frac{1}{6} \cdot \frac{1}{6} \cdot \frac{5}{6} = \frac{5}{216}$$

The chance of rain is $\frac{4}{5}$. The chance of lightning is $\frac{1}{3}$. The chance of both is $\frac{1}{4}$. What is the chance of rain **or** lightning?

$$\frac{4}{5} + \frac{1}{3} - \frac{1}{4} = \frac{53}{60}$$

Example 3:

Sarah has 9 dimes and 7 pennies in her pocket. She randomly selects one coin and then puts it back. She then pulls another coin out of her pocket. What is the probability that both coins are dimes?

$$\frac{9}{16} \cdot \frac{9}{16} = \frac{81}{256}$$

Example 4:

Sarah has 9 dimes and 7 pennies in her pocket. She randomly selects one coin and gives it to her brother. She then pulls another coin out of her pocket. What is the probability that both coins are dimes?

$$\frac{9}{16} \cdot \frac{8}{15} = \frac{3}{10}$$

There are 2400 subscribers to an internet service provider. Of these, 1200 own Brand A computers, 500 own Brand B and 100 own both A and B. What is the probability that a subscriber selected at random own either Brand A or Brand B?

$$\frac{1200}{2400} + \frac{500}{2400} - \frac{100}{2400} = \left(\frac{2}{3}\right)$$

3) A circuit board with 20 computer chips contains 4 chips that are defective. If 3 chips are selected, what is the probability that all 3 are defective?

$$\begin{array}{ccc} 1^{\text{st}} & 2^{\text{nd}} & 3^{\text{rd}} \\ \frac{4}{20} & \cdot \frac{3}{19} & \cdot \frac{2}{18} = \end{array} \left| \begin{array}{c} \text{All 3} \\ \frac{{}^4C_3}{{}^{20}C_3} = \end{array} \right. \boxed{\frac{1}{285}}$$

4) Mark is going on a road trip. He is debating between 8 movies and 9 playlists to listen to. If he chooses at random what is the probability that he selects 3 movies and 5 playlists?

Combinations

Last Unit →

$$\frac{{}^8C_3 \cdot {}^9C_5}{{}^{17}C_8} = \frac{56 \cdot 126}{24,310} =$$

New →

0.29