If rolling two dice and multiplying the dots on each die, would getting an even number or odd number be a fair game?
If rolling two dice and multiplying the dots on each die, would getting an even number or odd number be a fair game?

- **NO**, $P(\text{even}) = \frac{27}{36}$
- $P(\text{odd}) = \frac{9}{36}$

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Mutually Exclusive

Two events are **mutually exclusive** events if they cannot occur at the same time.

**Examples:**

- Flipping a coin and getting both heads and tails on the same toss — it cannot occur.
- Rolling a die and having it land six and five upward — both cannot occur simultaneously
Which events are mutually exclusive?

Single roll of a die:

• Rolling an odd number and an even number
• Rolling a 3 and odd number
• Rolling odd number and number less than 4

From a deck of cards:

• Drawing a 7 and jack
• Drawing a club and king
• Drawing a face card and an ace
Addition Rules

• When two events are mutually exclusive the
  \( P(A \text{ or } B) = P(A) + P(B) \).

• When two events are mutually exclusive
  \( P(A \text{ and } B) = 0 \) since both cannot occur.

• If two events are not mutually exclusive the
  \( P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \) since you
    are subtracting out the repeats

• \( P(A \text{ and } B) = P(A) \times P(B) \) since both can occur.
• An automobile dealer has 10 Fords, 7 Buicks, and 5 Plymouths in a used-car lot.

• What is the probability that a person will purchase a Ford or Buick?

• What is the probability that someone will buy a Ford or Plymouth?

• What’s the probability that someone will buy a Ford or Buick or Plymouth?
A deck of cards has 52 cards. Find the probability of drawing each.

• A diamond
• Four of clubs
• A jack or a queen
• An 8 or a spade
• A red king
• A black ace or a red ace
• A black card and a 10
A deck of cards has 52 cards. Find the probability of drawing each.

• A diamond = \( \frac{13}{52} = \frac{1}{4} \)
• Four of clubs = \( \frac{1}{52} \)
• A jack or a queen = \( \frac{8}{52} \)
• An 8 or a spade = \( \frac{4+13-1}{52} \rightarrow \frac{16}{52} \)
• A red king = \( \frac{2}{52} \)
• A black ace or a red ace = \( \frac{2+2}{52} \rightarrow \frac{4}{52} \)
• A black card and a 10
  = \( \frac{1}{2} \times \frac{4}{52} = \frac{2}{52} \)
The Bargain Auto Mall has these cars in stock

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If a car is selected at random, find the probability that it is

- Domestic
- Foreign and sedan
- Domestic or an SUV
The Bargain Auto Mall has these cars in stock

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If a car is selected at random, find the probability that it is

- \( P(\text{Domestic}) = \frac{210}{300} = .70 \)
- \( P(\text{Foreign and sedan}) \)
- \( P(\text{Domestic or an SUV}) \)
The Bargain Auto Mall has these cars in stock

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If a car is selected at random, find the probability that it is

- \( P(\text{Domestic}) = \frac{210}{300} = .7 \)
- \( P(\text{Foreign and sedan}) = \frac{20}{300} = .067 \) both
- \( P(\text{Domestic or an SUV}) \)
The Bargain Auto Mall has these cars in stock

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If a car is selected at random, find the probability that it is

- $P(\text{Domestic}) = \frac{210}{300} = .7$
- $P(\text{Foreign and sedan}) = \frac{20}{300} = .067$
- $P(\text{Domestic or an SUV}) = \frac{210 + 85 - 65}{300} \rightarrow \frac{230}{300} = .767$
Odds in Favor

The **odds** in favor of an event is the ratio of the number of ways the outcome *can* occur to the number of ways the outcome *cannot* occur.

For example, Samantha has 2 quarters, 5 dimes, and 3 nickels in her pocket.

a) What are the odds that she will pick a quarter out of her pocket?
   
   \[
   \text{Odds(quarter)} = \frac{2 \text{ quarters}}{8 \text{ not quarters}} = \frac{2}{8} = \frac{1}{4}
   \]

b) What are the odds that she will pick a quarter or a dime out of her pocket?
   
   \[
   \text{Odds(quarter or dime)} = \frac{7 \text{ are}}{3 \text{ not}} = \frac{7}{3}
   \]
Odds in Favor

• The **odds** in favor of an event is the ratio of the number of ways the outcome **can** occur to the number of ways the outcome **cannot** occur.

A bag of marbles contains 3 red marbles, 2 blue marbles, and 1 green marble. Find the odds of each outcome.

a) blue marble
b) red or green
c) green or blue
e) not green
Odds in Favor

• The odds in favor of an event is the ratio of the number of ways the outcome can occur to the number of ways the outcome cannot occur.

A bag of marbles contains 3 red marbles, 2 blue marbles, and 1 green marble. Find the odds of each outcome.

a) blue marble = 2 blue : 4 not = 1:2
b) red or green
c) green or blue
e) not green
Odds in Favor

• The **odds** in favor of an event is the ratio of the number of ways the outcome **can** occur to the number of ways the outcome **cannot** occur.

A bag of marbles contains 3 red marbles, 2 blue marbles, and 1 green marble. Find the odds of each outcome.

a) blue marble = 2 blue : 4 not = 1:2
b) red or green = 4 are: 2 not = 2:1
c) green or blue
e) not green
Odds in Favor

• The **odds** in favor of an event is the ratio of the number of ways the outcome **can** occur to the number of ways the outcome **cannot** occur.

A bag of marbles contains 3 red marbles, 2 blue marbles, and 1 green marble. Find the odds of each outcome.

a) blue marble = 2 blue : 4 not = 1:2
b) red or green = 4 are: 2 not = 2:1
c) green or blue = 3:3 = 1:1
e) not green
Odds in Favor

• The **odds** in favor of an event is the ratio of the number of ways the outcome **can** occur to the number of ways the outcome **cannot** occur.

A bag of marbles contains 3 red marbles, 2 blue marbles, and 1 green marble. Find the odds of each outcome.

a) blue marble = 2 blue : 4 not = 1:2

b) red or green = 4 are: 2 not = 2:1

c) green or blue = 3:3 = 1:1

e) not green = 5:1
Find the odds if you roll a six-sided die.

- Odds(5)
- Odds(even number)
- Odds (multiple of 2)
- Odds( number less than 3)
Find the odds if you roll a six-sided die.

- Odds(5) = 1:5
- Odds(even number) = 3:3 = 1:1
- Odds (multiple of 2)= 3:3 = 1:1
- Odds( number less than 3) = 2:4 = 1:2
Expectations

• If you roll a six-sided dice 100 times, how many times do you expect a six to land up?

Method 1

\[ P(6) = \frac{1}{6} \]

\[ \text{Expect}(6) = 100 \text{ rolls times } \frac{1}{6} = 16.7 \text{ times} \]

Method 2

\[ \frac{1}{6} = \frac{x}{100} \quad \text{so } x = 16.7 \]
You toss a four-sided dice.

a. What is the probability of rolling a 3?

b. How many times would you expect to roll a 3 in 1200 tosses?
You toss a four-sided dice.
a. What is the probability of rolling a 3?
   \[ P(3) = \frac{1}{4} \]
b. How many times would you expect to roll a 3 in 1200 tosses?
   \[ E(3) = \frac{1}{4} \times 1200 = 300 \text{ times} \]
You toss a four-sided dice.

c. How many times would you expect to roll an even number in 1000 tosses?

d. How many times would you expect to roll an odd number in 2000 tosses?
You toss a four-sided dice.

c. How many times would you expect to roll an even number in 1000 tosses?

\[ E(\text{even}) = \frac{1}{2} \times 1000 = 500 \text{ times} \]

d. How many times would you expect to roll an odd number in 2000 tosses?

\[ E(\text{odd}) = \frac{1}{2} \times 2000 = 1000 \text{ times} \]