

Name: _____ Block: _____ Date: _____

Probability and Predictions

In probability, an event is a result of a probability question. An outcome is a possible result of a probability event. A simple event is one outcome or a collection of outcomes. We find it by taking the ratio of the number of favorable outcomes (what we are looking for) to the number of possible outcomes.

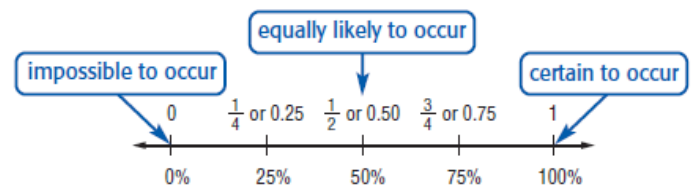
Probability is the chance some event will happen.

$$P(\text{event}) = \frac{(\text{number of favorable outcomes})}{(\text{number of possible outcomes})}$$

Example: What is the probability of choosing the letter E in Scrabble if we know that there are 12 "E" tiles in a game containing a total of 100 letter tiles?

We write: $P(E) = \frac{12}{100} = \frac{3}{25} = 12\%$

The probability of an event is always a number between 0 (impossible) and 1 (certain). The closer a probability is to 1, the more likely it is to occur. A scale of likelihood is shown at right:



The likelihood of something NOT occurring = $1 - P(\text{event DOES occur})$.

Theoretical vs. Experimental Probability

What we discussed above is called theoretical probability. It is what mathematics predicts **should** occur. Experimental probability is what **actually** occurs when conducting a probability experiment.

Example: The table shows the outcomes of a coin tossing experiment.

Outcome	Tally	Frequency
Heads		14
Tails		11

- 1) What is the experimental probability of getting tails?
- 2) What is the theoretical probability of getting tails?

You try: Suppose you have 2 red marbles, 4 blue marbles, 7 green marbles, and 5 yellow marbles in a bag. Find the theoretical probability for each outcome as a fraction and percent:

- a) $P(\text{blue})$
- b) $P(\text{yellow})$
- c) $P(\text{not green})$
- d) $P(\text{purple})$
- e) $P(\text{red or blue})$
- f) $P(\text{blue or yellow})$
- g) $P(\text{not orange})$
- h) $P(\text{not blue or not red})$
- i) Suppose two number cubes are rolled together. What is the probability of rolling two odd numbers?

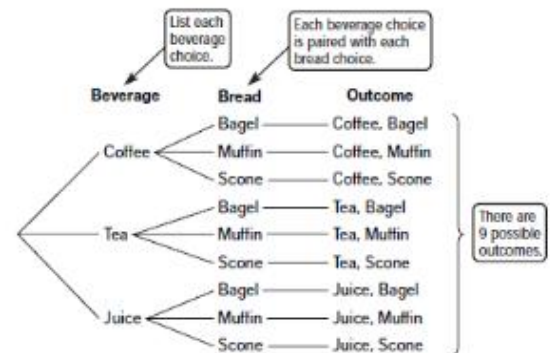
Counting Outcomes

To determine probabilities, we need to be able to know the total possible number of outcomes. We can use tree diagrams and the fundamental counting principle to help us determine possible number of outcomes.

Tree Diagrams

How many different kinds of beverages and bread can be made from 3 beverage choices and 3 bread choices?

The table at right illustrates how we can list the different possible combinations. We can see that there are a total of 9 possible outcomes.



The Fundamental Counting Principle can also be used to calculate possible outcomes.

The Fundamental Counting Principle

If event M can occur in m ways and is followed by event N that can occur in N ways, then the event M followed by N can occur $m \cdot n$ ways.

What this means is that we can multiply the number of different choices to get the number of total possible outcomes. In the example above, we have 3 choices of beverage and 3 choices of bread, so we have $3 \cdot 3 = 9$ possible outcomes.

Other examples:

How many outcomes are possible if you toss a coin and roll a 6-sided number cube?

b) A cell phone company offers 3 payment plans, 4 styles of phones, and 6 decorative phone wraps. How many phone options are available?

Finding Probabilities

What is the probability of tossing two coins and getting one head and one tail?

How many possible outcomes are there? _____

How many possible outcomes have one head and one tail? _____

Therefore the probability of one head and one tail is _____

You try:

a) What are the possible number of outcomes if one 6-sided number cube is rolled and one card is drawn from a 52-card deck?

b) A coin is tossed and a card is drawn from a 52-card deck. What is the probability of getting tails and the ten of diamonds?

c) What is the probability of winning a state lottery game where the winning number is made up of 4 digits from 0 to 9 chosen at random?