STUDENT RESOURCES

Word or Phrase	Definition
dependent events	Two events are <u>dependent</u> if the occurrence (or nonoccurrence) of one event affects the likelihood of the other. See <u>independent events</u>
event	An <u>event</u> is a subset of the sample space. See sample space. In the probability experiment of rolling a number cube, "rolling an even number" is an event, because getting a 2, 4, or 6 is a subset (part) of the sample space of {1, 2, 3, 4, 5, 6}.
experimental probability	In a repeated probability experiment, the <u>experimental probability</u> of an event is the number of times the event occurs divided by the number of trials. This is also called <u>empirical probability</u>. If, in 25 rolls of a number cube, we obtain an even number 11 times, we say that the experimental probability of rolling an even number is $\frac{11}{25} = 0.44 = 44\%$.
fair game	A game of chance is a <u>fair game</u> if all players have equal probabilities of winning. A two-person game of chance is a fair game if each player has probability $\frac{1}{2}$ of winning, that is, if each player has the same probability of winning as of losing.
independent events	Two events are <u>independent</u> if the occurrence (or nonoccurrence) of one event does not affect the likelihood of the other. See <u>dependent</u>. In the probability experiment of rolling a number cube and flipping a coin, the event of rolling a 1 is independent of the event of getting heads on the coin flip. The probability of rolling the 1 is $\frac{1}{6}$, no matter what the outcome of the coin flip is. In other words, the cube roll does not depend at all on the coin flip.
outcome	An <u>outcome</u> is a result of a probability experiment. If we roll a number cube, there are six possible outcomes: 1, 2, 3, 4, 5, 6.
percent	A <u>percent</u> is a number expressed in terms of the unit $1\% = \frac{1}{100}$. Fifteen percent = 15% = $\frac{15}{100}$ = 0.15. $\frac{5}{6} = 0.8\overline{3} = 83.\overline{3}\%$

Word or Phrase	Definition
probability	The <u>probability</u> of an event is a measure of the likelihood of that event occurring. The probability $P(E)$ of the event E occurring satisfies $0 \leq P(E) \leq 1$. If the event, E, is certain to occur, then $P(E) = 1$. If the event E is impossible, then $P(E) = 0$. When flipping a fair coin, the probability that it will land on heads is $\frac{1}{2} = 0.5 = 50\%$.
probability experiment	A <u>probability experiment</u> is an experiment in which the results are subject to chance. Rolling a number cube can be considered a probability experiment.
repeating decimal	A <u>repeating decimal</u> is a decimal that ends in repetitions of the same block of digits. The repeating decimal 52.19343434… ends in repetitions of the block "34." An abbreviated notation for the decimal is $52.19\overline{34}$, where the bar over 34 indicates that the block is repeated. The terminating decimal 4.62 is regarded as a repeating decimal. Its value is 4.620000…
sample space	The <u>sample space</u> for a probability experiment is the set of all possible outcomes of the experiment. In the probability experiment of rolling a number cube, the sample space can be represented as the set {1, 2, 3, 4, 5, 6}.
simulation	<u>Simulation</u> is the imitation of one process by means of another process. We may simulate rolling a number cube by drawing a card blind from a group of six identical cards labeled one through six. We may simulate the weather by means of computer models.
terminating decimal	A <u>terminating decimal</u> is a decimal whose digits are 0 from some point on. Terminating decimals are regarded as repeating decimals, though the final 0's in the expression for a terminating decimal are usually omitted. See <u>repeating decimal</u>. 4.62 = 4.62000000… is a terminating decimal with value $4 + \frac{6}{10} + \frac{2}{100}$.
theoretical probability	The <u>theoretical probability</u> of an event is a measure of the likelihood of the event occurring. In the probability experiment of rolling a (fair) number cube, there are six equally likely outcomes, each with probability $\frac{1}{6}$. Since the event of rolling an even number corresponds to 3 of the outcomes, the theoretical probability of rolling an even number is 3 out of 6, or $3 \cdot \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$.
trial	Each performance or repetition of a probability experiment is called a <u>trial</u>. Flipping a coin 25 times can be viewed as 25 trials of the probability experiment of flipping a coin once.

Phrases That Describe Probabilities

In their assessment reports on climate change, climate scientists attach the following probabilities to common expressions of likelihood:

Virtually certain:	> 99% probability
Extremely likely:	> 95% probability
Very likely:	> 90% probability
Likely:	> 66% probability
More likely than not:	> 50% probability
About as likely as not:	33 to 66% probability
Unlikely:	< 33% probability
Very unlikely:	< 10% probability
Extremely unlikely:	< 5% probability
Exceptionally unlikely:	< 1% probability

Estimating Probabilities from an Experiment With Equally Likely Outcomes

To estimate the probability of an event E, repeat the experiment a number of times and observe how many times the event occurs. The estimate for the probability of the event E occurring is then given by the fraction:

$$\text{estimate} = \frac{\text{number of times an event } E \text{ occurs}}{\text{number of trials}} = \frac{\text{numerator}}{\text{denominator}}$$

In a probability experiment of rolling a number cube with six equally likely outcomes, each has probability $\frac{1}{6}$.

The event of rolling an odd number corresponds to three outcomes: 1, 3, or 5. Below is data from an experiment where a cube is rolled 10 times.

Trial #	1	2	3	4	5	6	7	8	9	10
Outcome	4	5	6	3	5	2	1	6	4	2

In this experiment, an odd number occurred 4 times.

$\text{estimate(odd)} = \frac{4}{10} = \frac{2}{5} = 40\%$

Since the estimate is based on an experiment, different experiments may lead to different estimates.


Finding Theoretical Probabilities

In a probability experiment of rolling a number cube with six equally likely outcomes, each has probability $\frac{1}{6}$.

The event of rolling an odd number corresponds to three outcomes: 1, 3, or 5. Thus the theoretical probability of rolling an odd number is given by the fraction:

$$P(E) = \frac{\text{number of outcomes in an event } E}{\text{total number of outcomes}} = \frac{3}{6} = \frac{1}{2} = 50\%$$

Sample Space Displays

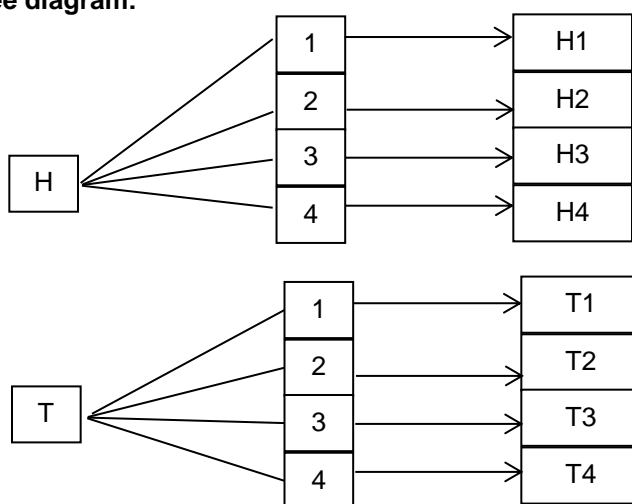Suppose our experiment is to flip a coin and then spin the spinner.
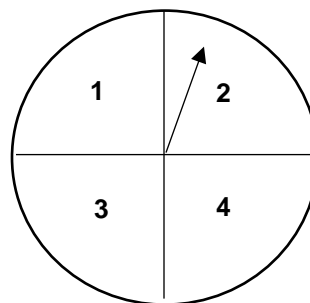
Below are three ways to show all the outcomes (or the sample space) of the experiment.

1. **Outcome grid:**

		Spinner			
		1	**2**	**3**	**4**
Coin Flip	**Heads (H)**	H1	H2	H3	H4
	Tails (T)	T1	T2	T3	T4

2. **Tree diagram:**

3. **List**

   H1   H2   H3   H4
   T1   T2   T3   T4