

4-4 Probability

If you have a standard deck of 52 cards, what is the probability your friend will draw a king of hearts? There is one king of hearts and 52 different cards to draw, so the probability is $\frac{1}{52}$.

In probability, an **event** is something that can happen in an **experiment**. Flipping a coin, drawing a card, and rolling a die are examples of experiments. For the experiment of flipping a coin, heads is one event and, tails is the other possible event. There are six possible events when a single die is rolled. A **sample space** is all the possible events. The sample space for a single coin toss is {heads, tails}

The probability of an event (E) is the number of ways E can happen divided by the number of possible things in the sample space.

Example: What is the probability that a 2 or a 3 is rolled when a single 6 sided dice is rolled? There are two ways to get a 2 **or** 3. There are 6 ways the dice could land. The probability is $\frac{2}{6}$. Always reduce a probability. This makes the probability $\frac{1}{3}$. Another way to write the same thing is $33\frac{1}{3}\%$. A probability can also be a decimal, 0.333

Example: What is the probability that a number 1, 2, 3, 4, 5, or 6 will turn up when a six sided dice is rolled?

There are 6 ways for one of those numbers to come up. There are 6 ways for a dice to be rolled.

$\frac{6}{6}$ is 1 or 100%

A certainty is when the probability is 1

Example: What is the probability that an 8 will turn up on a single roll of a standard six sided dice?

There are 0 ways to get an 8 and 6 ways to roll a six sided dice. $\frac{0}{6} = 0$

An event with no chance has a probability of 0.

You need to assume that the dice above are fair. That is each roll has an equally likely chance of coming up. Probability is a little different if each event doesn't have an equal chance.

Practice:

a) My daughter has a spinner for a game. There are 4 colors on the spinner: green, blue, yellow and red. What is the probability that she will spin a red?

b) Jack rolls a single six sided dice. What is the probability that he rolls a 4?

What is the probability that he rolls an even number?

What is the probability that he rolls an odd number?

What is the probability that he rolls a number less than 5?

What is the probability that he rolls a 12?

What is the probability that he rolls a number less than 12?

c) Jill draws a card from a deck standard of cards. What is the probability that she draws the ace of spades?

What is the probability that she draws a spade?

What is the probability that she draws a king?

What is the probability that she draws a red card?

What is the probability that she draw a face card? (An ace is not a face card.)

What is the probability that she draws an ace or a red card? (You can't count the red aces twice.)

Here is the table of the sample space for a roll of two dice where one is red and the second is blue.

	1	2	3	4	5	6
1	(1, 1)	(2, 1)	(3, 1)	(4, 1)	(5, 1)	(6, 1)
2	(1, 2)	(2, 2)	(3, 2)	(4, 2)	(5, 2)	(6, 2)
3	(1, 3)	(2, 3)	(3, 3)	(4, 3)	(5, 3)	(6, 3)
4	(1, 4)	(2, 4)	(3, 4)	(4, 4)	(5, 4)	(6, 4)
5	(1, 5)	(2, 5)	(3, 5)	(4, 5)	(5, 5)	(6, 5)
6	(1, 6)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)

Example: What is the probability that the sum of the rolls of two dice (red and blue) is 8?
 (5, 3) , (3, 5), (2, 6), (6, 2) and (4,4) all add to 8. There are five ways to roll an 8. There are 36 total way to roll two dice.

The probability is $5/36$ or 0.1389 (rounded) or $13\frac{8}{9}\%$.

- d) What is the probability the sum of the two dice rolled will be 2?
 What is the probability the sum of the two dice rolled will be 12?
 What is the probability the sum of the two dice rolled will be more than 12?
 What is the probability the sum of the two dice rolled will be less than 12?
 What is the probability the sum of the two dice rolled will be even?
 What is the probability that the two dice rolled will be the same?
 What is the probability the sum of the two dice rolled will be 7?
- e) There are 7 women and 10 men in a class. A class president is to be chosen at random. What is the probability that the president will be a man?
- f) Bob bought 7 raffle tickets at \$1 each. There were 4900 tickets sold. What is the probability that Bob will win?
- g) An urn contains 8 balls. 3 are red, 2 are white, 1 is blue, 1 is black, and 1 is green.
 Randy draws one ball.
 What is the probability he draws a blue ball?
 What is the probability he draws a white ball?
 What is the probability he draws a red ball?
 What is the probability he draws a red or white ball?
- h) A jar contains one red and nine white beads. Janet draws a bead out of jar.
 What is the probability she draws a red bead?
 What is the probability she draws a white bead?
 What is the probability she draws a blue bead?
- i) Think about the lottery in your state. The probability that you will win is about $1/25,000,000$.
 Imagine a giant bowl of 25,000,000 beads. All but one is white. One is red. You are blindfolded. You pay one dollar each time you draw out a bead. If you pull out the one red bead you win the lottery. If not, you win nothing. This simulates what happens when you buy a lottery ticket.
 Find out what the actual probability of winning the lottery is if you buy one ticket. This information should be available where you buy lottery tickets.