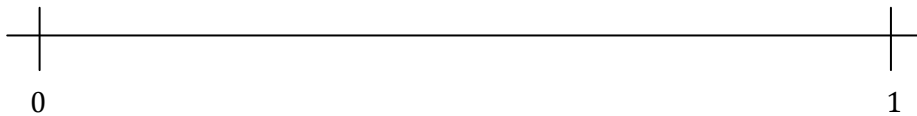# Probability

**Overview:** In math, probability is how likely it is that something will occur (or not). Probability is expressed in a range from 0 to 1. A probability of zero means that a thing will definitely not happen – it's impossible. But a probability of one means that it definitely will happen – it's certain. Any number larger than 0, but smaller than 1, means that a thing might happen. The number 1/2, or one half, is right in the middle and it means there is a 50/50 chance. Do you think there's a greater chance for a person to get struck by lightning, or to be hit by a meteorite?

**Materials**

- Pencil
- Paper

**Activity:** Some key words that help with probability questions are OR and AND. When you see the word OR, it means you should be adding the possible outcomes to find out the probability whether one thing OR another will happen. The word AND means you will probably be multiplying to find the solution.



0                                                                                       1

When something will not happen at all, then its probability of happening (the chances of it happening) is zero. When we are sure that something will definitely happen, the probability of occurrence is 1. When the probability is between 0 and 1, then something may or may not happen.

For example, if you flip a two-sided coin, you have two possibilities: a head or a tail side to show. The total number of possible outcomes is 2. Since only one side can be at the top, we have only one possible outcome. So the probability of a tails (or heads) showing after you flip it is:

$$\frac{Possible\ outcome}{Total\ possible\ outcomes} = \frac{1}{2}$$

Let's take an example. What is the probability that when a six-sided die is rolled, it will show a 1 or a 2?

Since a die has 6 faces, I expect only one face to show after I roll it, so all the faces have equal chances of showing up.



Using the formula above, the probability a 1 will show up is $\frac{1}{6}$, while the probability that 2 will show up is $\frac{1}{6}$.
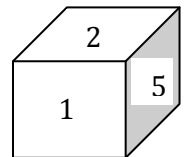
Because the questions asked for the probability of a 1 OR a 2, we add them together: $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

Let's try another example: what is the probability that a 6 and a 6 will show up in two successive rolls?

The probability that one 6 will show up is $\frac{1}{6}$, so the probability that a six *and* a six will show up is the product $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$. Since the question asked was a 6 *and* a six, the probabilities get multiplied together.

Just for reference: the probability that you will be struck by a meteorite is 1 in a trillion. The chance of being struck by lightning is 1 in ten million.

Now it's your turn! Work out the exercises below. (You'll find answers at the back of this book.)

**Exercises**

1. What is the probability of a coin showing tails when flipped?
2. What is the probability of a coin showing heads twice in a row?
3. What is the probability that heads *or* tails will show up in a toss?
4. What is the probability that heads *and* tails will show up in two successive tosses?
5. A die is rolled once: what is the probability that a four will show up?
6. A die is rolled once: what is the probability that a three will show up?
7. A die is rolled once: what is the probability that a four *or* a six will show up?
8. A die is rolled twice: what is the probability that a four will show up in all the rolls?
9. A die is rolled twice: what is the probability that a four *and* a two will show up?
10. A die is rolled twice: what is the probability that the same number will show up in all the rolls?

**Answers to Exercises: Probability**

1. $\frac{1}{2}$
2. $\frac{1}{4}$
3. $1$
4. $\frac{1}{2}$
5. $\frac{1}{6}$
6. $\frac{1}{6}$
7. $\frac{1}{3}$
8. $\frac{1}{36}$
9. $\frac{1}{18}$
10. $\frac{1}{6}$