

Grade 7 · Probability of Compound Events · Lesson

Common Core 7.SP.C.8 · mathovore.fr

A compound event combines two or more simple events, such as flipping a coin and rolling a number cube. To find its probability, list the sample space with an organized list, a table or a tree diagram, then divide the number of favorable outcomes by the total number of equally likely outcomes.

Grade 7 Common Core: 7.SP.C.8

Key facts:

- Standard 7.SP.C.8: find probabilities of compound events using lists, tables, tree diagrams and simulation.
- A tree diagram shows every outcome as one path: a coin and a spinner with 3 equal sections give $2 \times 3 = 6$ outcomes.
- Two number cubes have 36 equally likely outcomes, and 6 of them give a sum of 7.
- Drawing without replacement leaves fewer choices on the second draw than drawing with replacement.
- A simulation gives an estimate that gets closer to the true probability as the number of trials grows.

What is a compound event?

A **compound event** combines two or more simple events, such as flipping a coin and then spinning a spinner. Each outcome is a complete result of every stage, like heads and red. When all outcomes are equally likely, the probability of an event is the fraction of the sample space that fits it.

Vocabulary

Sample space: the list of all possible outcomes.

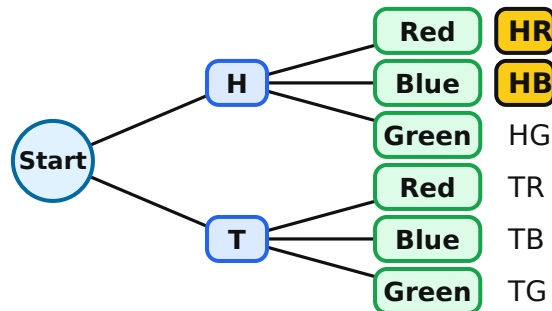
Favorable outcomes: the outcomes that match the event you want.

Simulation: a model, such as random digits, that imitates a chance event many times.

How do you list every outcome?

Three tools keep a list complete:

- **Organized list:** keep the first choice fixed and run through the second, then move to the next first choice.
- **Table:** put one stage in the rows and the other in the columns.
- **Tree diagram:** each branch is one choice, and each path from Start to the end is one outcome.



A coin and a spinner give $2 \times 3 = 6$ outcomes. The highlighted paths are heads with red or heads with blue.

How do you find the probability of a compound event?

1. Build the whole sample space.
2. Count all outcomes.
3. Count the outcomes that match the event.
4. Write favorable over total and simplify.

Worked example. Maya flips a coin and spins a spinner with three equal sections: red, blue and green. Find the probability of heads and not green. The tree has 6 outcomes. Two of them, HR and HB, match, so the probability is $\frac{2}{6} = \frac{1}{3}$.

For two number cubes, the table has 36 cells and six of them show a sum of 7, so the probability of a sum of 7 is $\frac{6}{36} = \frac{1}{6}$.

Cube 2						
Cube 1	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Sums of two number cubes. Highlighted cells have sum 7.

What changes when an item is not put back?

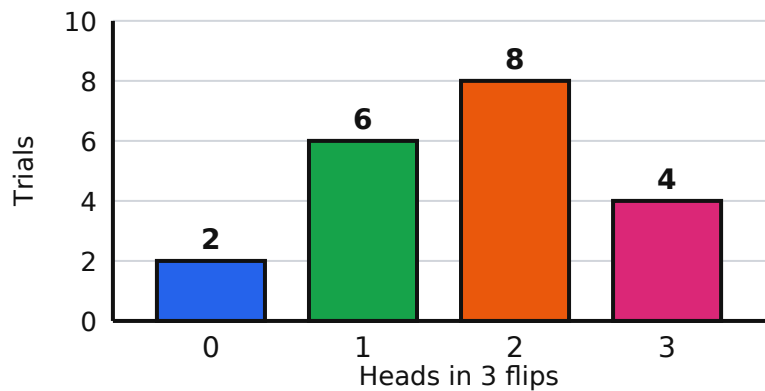
A bag holds a red, a blue and a green marble. Drawing two marbles **with replacement** gives $3 \times 3 = 9$ outcomes. Drawing **without replacement** removes the pairs that repeat a marble, leaving $3 \times 2 = 6$ outcomes.

2nd draw			
1st	R	B	G
R		RB	RG
B	BR		BG
G	GR	GB	

The crossed cells cannot happen without replacement, so six outcomes remain.

How does a simulation estimate a probability?

To estimate the chance of at least 2 heads in 3 flips, flip a coin three times and record the heads. Repeat for 20 trials. Here 12 of the 20 trials had at least 2 heads, so the estimate is $\frac{12}{20} = \frac{3}{5}$. The true probability is $\frac{4}{8} = \frac{1}{2}$; an estimate is close but rarely exact.



Twenty simulated trials. The bars for 2 and 3 heads add to $8+4=12$.

Probability of Compound Events: frequently asked questions

What is a compound event in probability?

A compound event is an event that involves two or more simple events, such as flipping a coin and rolling a number cube, or drawing two marbles from a bag. Its outcomes combine the results of every stage, for example heads and a 4.

How do you find the sample space of a compound event?

Make an organized list, a table or a tree diagram so no outcome is missed or repeated. For two stages, multiply the number of choices: 3 shirts and 4 pants give $3 \times 4 = 12$ outfits.

What is the difference between with and without replacement?

With replacement, the first item goes back before the second draw, so both draws have the same choices. Without replacement, the first item stays out, so the second draw has fewer choices and some pairs, like drawing the same marble twice, become impossible.

How many outcomes are there when you roll two number cubes?

There are $6 \times 6 = 36$ equally likely outcomes. A table with 6 rows and 6 columns shows all of them, and six of the cells have a sum of 7, so the probability of a sum of 7 is $\frac{6}{36} = \frac{1}{6}$.

What is a simulation and how many trials should you run?

A simulation uses a simple device, such as random digits or a number cube, to imitate a chance event many times. More trials usually give an estimate closer to the true probability, so 100 trials are better than 10.