

4 Theoretical Probability

Goal

Create a list of all possible outcomes to determine a probability.

Angele and Akeem each roll a die. Angele wins if she rolls a 4. Akeem wins if the sum of both of their rolls is 4. Otherwise, it's a tie.

? Why is Angele more likely to win than Akeem?

**Angele's Method**

Instead of doing an experiment, I'll make a chart to show all of the possible **outcomes**.

Each outcome is just as likely as any other, so I'll make the same size box for each.

I'll write W if I win, L if I lose, and T for a tie.

		Angele's roll					
		1	2	3	4	5	6
Akeem's roll	1	T	T	L	W	T	T
	2				W		
	3				W		
	4				W		
	5				W		
	6				W		

I roll 4 and Akeem rolls 2.

There are 6 rows, one for each possible roll for Akeem, and 6 columns, one for each possible roll for me.

There are 36 possible outcomes in the chart.

The only L in the first row is if I roll 3 and Akeem rolls 1.

The only Ws are in the column under my roll of 4.

These are the favourable outcomes for the event 'I win.'

The **theoretical probability** that I will win is $\frac{6}{36}$.

theoretical probability

The probability you would expect when you analyze all of the different possible outcomes.

For example, the theoretical probability of flipping a head on a coin is $\frac{1}{2}$, since there are 2 equally likely outcomes and only 1 is favourable.

Experimental probability is the probability that actually happens when you do the experiment.

- Complete the chart. Use W if Angele wins, L if she loses, and T if she ties.
- Is Angele more likely to win than Akeem? Explain.

Reflecting

- Why did Angele say that the theoretical probability of her winning on any roll is $\frac{6}{36}$?
- How could you have predicted that there would be 36 outcomes?
- How do you know that the chart includes all possible outcomes for the game?

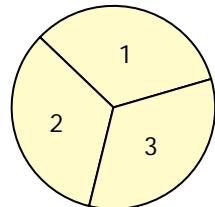
Checking

- If you roll two dice, what is the theoretical probability of each of these events?
 - sum of 8
 - sum of 7
 - sum of 3

Practising

- If you roll two dice, what is the theoretical probability of each event?
 - difference of 3
 - difference of 1
 - difference of 0
- Imagine spinning this spinner twice.
 - Does the chart show all of the possible outcomes? Explain.
 - How could you have predicted there would be 9 outcomes with two spins?
 - What is the theoretical probability that the sum of the two spins is an even number?
 - What is the theoretical probability that the sum is greater than 2?
- A computer randomly chooses a 2-digit counting number between 1 and 100. What is the theoretical probability of each event?
 - The number is less than 50.
 - The number is even.
 - The number is a multiple of 5.
 - The ones digit of the number is greater than the tens digit.

		First Roll					
		1	2	3	4	5	6
Second roll		1	2	3			
		2	3	4			
		3	4				
		4	5				
		5	6				
		6	7				



		First spin		
		1	2	3
Second spin		1		
		2		
		3		

X	X	X	X	X	X	X	X	X	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30