

# Theoretical Probability



## Quick Review

- This table shows the possible outcomes when 2 dice are rolled and the numbers are added.

+	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

From the table:

- There are 36 possible outcomes.
- 18 outcomes are odd sums.
- 18 outcomes are even sums.

We say: The **probability** of getting an odd sum is 18 out of 36.

We write the probability of an odd sum as a fraction:  $\frac{18}{36}$

This probability is a **theoretical probability**.

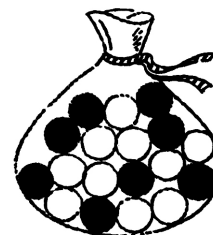
$$\text{Theoretical probability} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

The probability of an odd sum is  $\frac{18}{36}$ . The probability of an even sum is  $\frac{18}{36}$ .

Since  $\frac{18}{36} = \frac{18}{36}$ , the probability of getting an odd sum or an even sum is equally likely.

## Try These

1. A bag contains 10 white marbles and 8 black marbles. A marble is picked at random. What is the probability that a black marble is picked? \_\_\_\_\_
2. 16 girls and 13 boys put their names in a bag. One name is drawn from the bag. What is the probability that a boys name will be drawn? \_\_\_\_\_



## Practice

1. A box contains 8 red apples, 10 green apples, and 12 yellow apples. Without looking, you pick an apple from the box.

a) What are the possible outcomes?

\_\_\_\_\_

b) How many apples are in the box? \_\_\_\_\_

c) What is the theoretical probability that the apple is:

i) red? \_\_\_\_\_ ii) green? \_\_\_\_\_ iii) yellow? \_\_\_\_\_

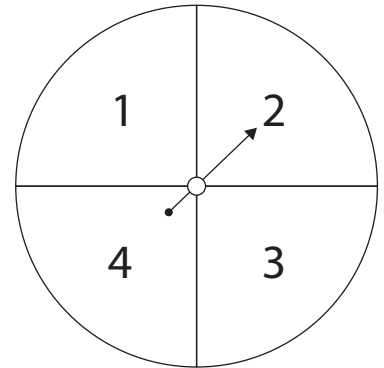
2. Suppose you spin the pointer on this spinner. What is the probability of each outcome?

a) The pointer lands on 1. \_\_\_\_\_

b) The pointer lands on 2. \_\_\_\_\_

c) The pointer lands on 3 or 4. \_\_\_\_\_

d) The pointer does not land on 3. \_\_\_\_\_



3. Rafik spins the pointer on this spinner.

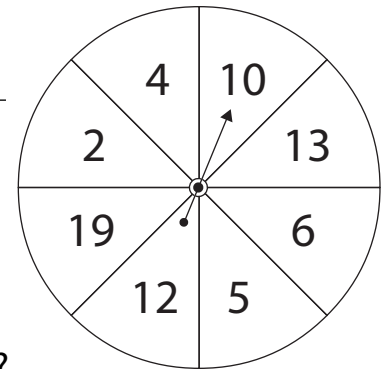
a) List the possible outcomes. \_\_\_\_\_

b) What is the probability of each outcome?

i) The pointer lands on a prime number? \_\_\_\_\_

ii) The pointer lands on a composite number? \_\_\_\_\_

iii) The pointer lands on a number greater than 10? \_\_\_\_\_



## Stretch Your Thinking

Draw and colour marbles in the bag so that the probability of picking a green marble is greater than the probability of picking a red marble, but less than the probability of picking an orange marble.



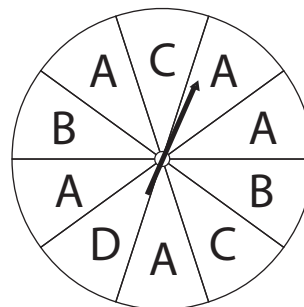
# Experimental Probability



## Quick Review

- Saul spun the pointer on this spinner 10 times. The theoretical probability of landing on the letter A is  $\frac{5}{10}$ , or  $\frac{1}{2}$ . Here are Saul's results.

<b>Letter</b>	A	B	C	D
<b>Number of Times</b>	6	1	2	1



The **experimental probability** is the likelihood that something occurs based on the results of an experiment.

$$\text{Experimental probability} = \frac{\text{Number of times an outcome occurs}}{\text{Number of times the experiment is conducted}}$$

The experimental probability of landing on the letter A is  $\frac{6}{10}$ , or  $\frac{3}{5}$ . This is different from the theoretical probability.

- Saul combined the results from 10 experiments.

<b>Letter</b>	A	B	C	D
<b>Number of Times</b>	51	19	8	22

The experimental probability of landing on the letter A is  $\frac{51}{100}$ . The experimental probability is close to the theoretical probability. The more trials we conduct, the closer the experimental probability may come to the theoretical probability.

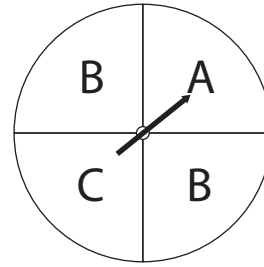
## Try These

- Look at the table of Saul's individual results. What is the experimental probability of landing on:
  - i) B? \_\_\_\_\_ ii) C? \_\_\_\_\_ iii) D? \_\_\_\_\_ iv) B or C? \_\_\_\_\_ v) A or D? \_\_\_\_\_
- Look at the table of Saul's combined results. What is the experimental probability of landing on:
  - i) B? \_\_\_\_\_ ii) C? \_\_\_\_\_ iii) D? \_\_\_\_\_ iv) B or D? \_\_\_\_\_

## Practice

1. Tatiana spins the pointer on this spinner several times. Here are her results.

A	B	C



- a) How many times did Tatiana spin the pointer? \_\_\_\_\_
- b) What fraction of the spins were A? \_\_\_\_\_ B? \_\_\_\_\_ C? \_\_\_\_\_
2. A coin is tossed 100 times. Heads showed 43 times and tails showed 57 times.
- a) What are the possible outcomes? \_\_\_\_\_
- b) What is the experimental probability of the tosses showing:
- i) heads? \_\_\_\_\_ ii) tails? \_\_\_\_\_
- c) What is the theoretical probability of the tosses showing:
- i) heads? \_\_\_\_\_ ii) tails? \_\_\_\_\_

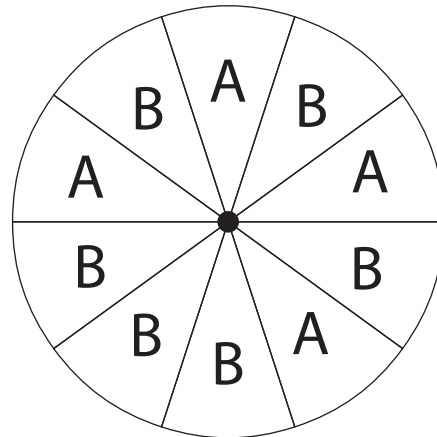
## Stretch Your Thinking

- a) What is the theoretical probability of the pointer landing on:

i) A? \_\_\_\_\_ ii) B? \_\_\_\_\_

- b) Use an opened paper clip as a pointer. Spin it 100 times. Record the results.

A	B



- c) What is the experimental probability of the pointer landing on:

i) A? \_\_\_\_\_ ii) B? \_\_\_\_\_