

 **Learning Objective:** To understand and apply theoretical probability

Theoretical Probability

The probability of an event is written as a decimal, a fraction or a percentage.

Theoretical probability is the likelihood that an event will occur when a fair experiment takes place.

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

The probability of the event is equal to **the number of favourable outcomes** divided by the total number of outcomes

For example, the chance of rolling a fair die once and getting an odd number is worked out as follows:

Favourable outcomes = odd numbers = {1, 3, 5}

Total number of outcomes = sample space = S = {1, 2, 3, 4, 5, 6}

$$P(\text{odd number}) = P(1, 3 \text{ or } 5) = \frac{3}{6} = \frac{1}{2} \text{ (also = 50\% = 0.5)}$$

The complementary event is all the other possible outcomes.

Non- favourable outcomes = {2, 4, 6}

Consider this spinner. Write down the theoretical probability of each event happening.



Spinning an odd number

Spinning a number over five

Complete the questions below.

A bag contains 14 red marbles, 5 blue marbles and 6 yellow marbles. Find the theoretical probability of getting a blue marble.

A bag contains 6 purple marbles, 8 orange marbles and 14 blue marbles. Find the theoretical probability of getting an orange marble.

A bag contains 8 green marbles, 14 red marbles and 9 pink marbles. Find the theoretical probability of getting a pink marble.

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Spinning an odd number

$$\begin{aligned} P(\text{Odd}) &= \{3, 5, 7, 9\} \\ &= 4 / 8 \\ &= 1 / 2 \end{aligned}$$

Spinning a number over five

$$\begin{aligned} P(>5) &= \{6, 7, 8, 9\} \\ &= 4 / 8 \\ &= 1 / 2 \end{aligned}$$

Complete the questions below.

A bag contains 14 red marbles, 5 blue marbles and 6 yellow marbles. Find the theoretical probability of getting a blue marble.

$$\begin{aligned} P(\text{Blue}) &= \{5 / 25\} \\ &= \{1 / 5\} \end{aligned}$$

A bag contains 6 purple marbles, 8 orange marbles and 14 blue marbles. Find the theoretical probability of getting an orange marble.

$$\begin{aligned} P(\text{Orange}) &= \{8 / 28\} \\ &= \{2 / 7\} \end{aligned}$$

A bag contains 8 green marbles, 14 red marbles and 9 pink marbles. Find the theoretical probability of getting a pink marble.

$$P(\text{Pink}) = \{9 / 31\}$$