Year 10
Maths

Lesson 6
Probability 1

1. The Language Of Probability

☐   The probability continuum

■   Probability is the field of mathematics that deals with chance. It assigns a value between 0 and 1 inclusive to indicate the likelihood that an event will occur.

   —   If it is **impossible** that an event will occur, it has a **probability of 0**.
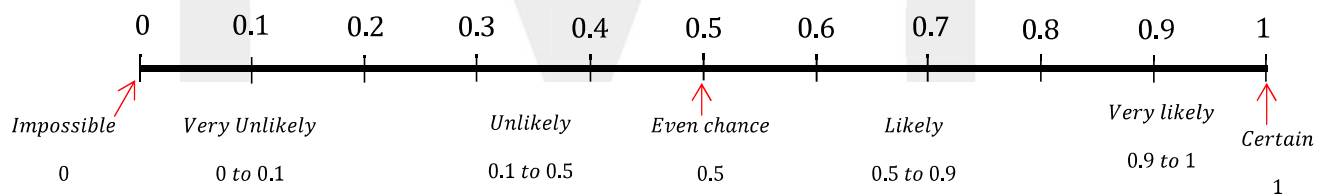
> **Discussion**
>
> Describe an event that has a probability of 0.
>
> _____
>
> _____

   —   If an event is **certain** to occur, it has a probability of 1.

> **Discussion**
>
> Describe an event that has a probability of 1.
>
> _____
>
> _____

■   All other events between these two extremes are assigned a probability between 0 and 1. The number line below shows how different probabilities are interpreted.

0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1

Impossible   *Very Unlikely*   *Unlikely*   *Even chance*   *Likely*   *Very likely*   *Certain*

0   *0 to* 0.1   0.1 *to* 0.5   0.5   0.5 *to* 0.9   0.9 *to* 1   1

> **DISCUSSION**
>
> Describe an event that has an even chance of occurring.
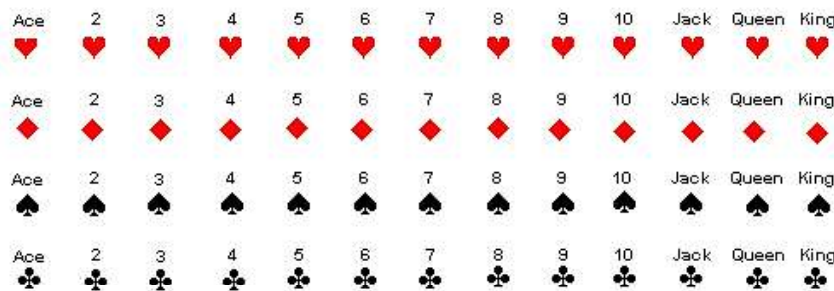>
> _____
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☐ **Random experiments**

■ A **random experiment** is a process in which we observe something uncertain and cannot predict the results (the **outcomes**).

■ The set of all the possible outcomes of a random experiment is called the **sample space.** For example:

— Sample space for flipping a coin: {H, T}

— Sample space for choosing a card from a standard deck:

— Sample space for rolling a die twice:

■ If there are n possible outcomes in a random experiment and each outcome has an equal chance of occurring, the outcomes are called **equally likely** outcomes and assigned the value $\frac{1}{n}$. For example:

— On Board A, $P(\text{Red}) = P(\text{Black}) = P(\text{White}) = \frac{2}{6} = \frac{1}{3}$. These are equally likely outcomes.

— In contrast, on Board B, $P(\text{Red}) = \frac{3}{6} = \frac{1}{2}, P(\text{Black}) = \frac{1}{6}$ and $P(\text{White}) = \frac{2}{6} = \frac{1}{3}$. These are NOT equally likely outcomes.
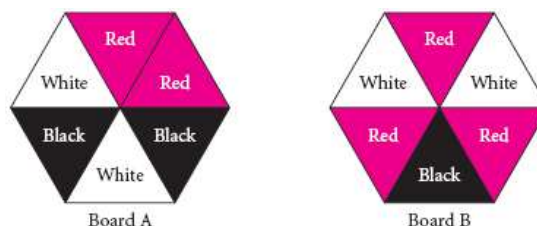
Concept Check 1.1
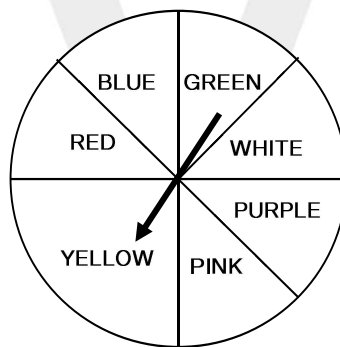
For the following random experiments:

    (i) List the sample space.

    (ii) State whether the outcomes are equally likely or not.

(a) Tossing an unbiased coin once [1]

_____

_____

(b) Simultaneously selecting 2 discs from a bag containing 3 red, 2 green and 1 white disc [2]

_____

_____

(c) Undertaking a test to gain a driving licence [3]

_____

_____

(d) Spinning the spinner shown in the diagram below once [4]

_____

_____

(e) Select a letter from a page of print. [5]

_____

_____

Concept Check 1.2

(a) "A bag contains green, black, white and red jellybeans. Therefore, if I choose one jellybean at random from the bag, the probability that it is black is $\frac{1}{4}$." Is this statement true or false? Explain your answer. [6]

(b) Two coins are tossed simultaneously. For this experiment, the possible outcomes are 2 heads, 1 head and no heads. Are these outcomes equally likely? Justify your answer. [7]

(c) "There are 26 letters in the alphabet. There are five vowels in the alphabet. This means that when I select a letter at random from a page of print, the probability that the letter will be a vowel is $\frac{5}{26}$." Is this statement correct? Give a reason for your answer. [8]

2.Experimental Vs Theoretical Probability

☐ Experimental probability

■ Experimental probability, or **relative frequency,** is calculated using the **results of an experiment** conducted many times. Mathematically,

$$\text{Relative frequency} = \frac{\text{Number of times the event occured}}{\text{Total number of trials}} = \frac{f}{\sum f}$$

■ Use this website to conduct a coin toss experiment. In the table below, record the number of heads that appear in 10 trials.

Number of heads	Frequency	Relative frequency
0		
1		
2		
Total	10	

■ Experimental probability is never fixed. Each time you conduct this coin toss experiment you will get different relative frequencies for each of the outcomes.

Concept Check 2.1

(a) A group of Y10 students were surveyed to find out their shoe sizes. The table below shows the results:

Shoe Size	5	6	7	8	9	10	11	12
No. of Students	3	7	9	15	19	10	4	3

A person is chosen at random from the group. What is the probability that the person has a shoe size:

(i) 6? [9]

_____

(ii) Less than 7? [10]

_____

(iii) 9 or greater? [11]

_____

(b) The table shows the voting preferences in a particular electorate in a State election.

Party	Percentage
Liberal	55%
Labor	40%
Independent	5%

A newspaper reporter chooses a voter from this electorate at random from the electoral roll. What is the probability that the voter is:

(i) *Not* a Liberal voter? [12]

_____

(ii) A Liberal or Labor voter? [13]

_____

(c) A biased coin is tossed 60 times and the following table shows the results.

Outcome	Frequency
Head	15
Tail	45

If the same coin is tossed a very large number of times, what is the closest estimate of the chance that the 3000th toss is a tail? [14]

_____

_____

(d) A goal kicker for a football team averages 46 goals out of every 50 goal attempts. In a particular match the goal kicker only had one attempt. What is the chance that he misses? [15]

_____

_____

(e) The table below illustrates the status of women in a small country town.

	Single	Married
0 to 18 years	74	1
19 years and over	27	88

(i) How many women are there in the country town? [16]

_____

(ii) If one of the women were selected at random, find the probability that she is:

   (α) Married [17]

_____

(β) Married and under 19 years of age [18]

_____

(γ) Single and over 19 years of age [19]

_____