

Probability 1

chapter

1

Section 1.3 Elementary probability

- The Probability of an event happening, $P(E)$, is always fraction between 0 and 1.

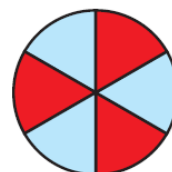
$$\text{if: } P(E) = 0 \quad \text{it is impossible}$$

$$P(E) = 1 \quad \text{it is certain}$$

- The chance of getting a red with this spinner is the same as the chance of getting a blue. Getting a red and getting a blue are **equally likely**. $\Rightarrow P(\text{red}) = \frac{1}{2}$

In general, if E represents an event, the probability of E occurring, denoted by $P(E)$, is given below:

$$P(E) = \frac{\text{number of successful outcomes in } E}{\text{number of possible outcomes}}$$



- Since it is certain that every event will either happen or not happen

$$\Rightarrow P(E) + P(\text{not } E) = 1$$

Example 1

If a card is drawn from a pack of 52, find the probability that it is

- (i) an ace (ii) a diamond (iii) a red card.

$$P(E) = \frac{\# \text{favourable outcomes}}{\# \text{possible outcomes}}$$

$$(i) \quad P(\text{ace}) = \frac{4}{52} = \frac{1}{13}$$

$$(ii) \quad P(\text{diamond}) = \frac{13}{52} = \frac{1}{4}$$

$$(iii) \quad P(\text{red}) = \frac{26}{52} = \frac{1}{2}$$

Example 2

A letter is selected at random from the letters of the word STATISTICS.

Find the probability that the letter is

- (i) C (ii) S (iii) S or T (iv) a vowel.

$$P(E) = \frac{\# \text{favourable outcomes}}{\# \text{possible outcomes}}$$

10 letters

1 C

3 Ss

3 Ts

3 vowels

$$(i) \quad P(C) = \frac{1}{10}$$

$$(ii) \quad P(S) = \frac{3}{10}$$

$$(iii) \quad P(S \text{ or } T) = \frac{6}{10} = \frac{3}{5}$$

$$(iv) \quad P(\text{vowel}) = \frac{3}{10}$$

Two events – use of sample spaces

When two coins are tossed, the set of possible outcomes is

$\{HH, HT, TH, TT\}$, where H = head and T = tail.

This set of possible outcomes is called a **sample space**.



Sample space is a list or table showing all possible outcomes

SAMPLE SPACE - 2 COINS

	H	T
H	•	•
T	•	•

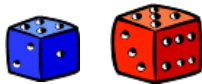
Fundamental principle of counting
 \Rightarrow there are $2 \times 2 = 4$ possible outcomes

Example 3

If two dice are thrown and the scores are added, set out a sample space giving all the possible outcomes. Find the probability that

- (i) the total is exactly 7
- (ii) the total is 4 or less
- (iii) the total is 11 or more
- (iv) the total is a multiple of 5.

Roll 2 dice



Fundamental principle
 $\Rightarrow 6 \times 6 = 36$ possible outcomes

SAMPLE SPACE - 2 DICE (Showing totals)

	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

- (i) $P(7) = \frac{6}{36} = \frac{1}{6}$
- (ii) $P(4 \text{ or less}) = \frac{6}{36} = \frac{1}{6}$
- (iii) $P(11 \text{ or more}) = \frac{3}{36} = \frac{1}{12}$
- (iv) $P(\text{multiple of } 5) = \frac{7}{36}$