

MATHEMATICS • CLASS 10

CHAPTER 14

Probability

CHAPTER NOTES



RANDOM EXPERIMENTS, OUTCOMES & EVENTS

- **Experiment**: an action or process that gives an observable result.
- **Trial**: one performance of the experiment.
- **Outcome**: one possible result of a trial.
- **Random experiment**: its possible outcomes are known, but the actual outcome cannot be predicted with certainty before the trial.

- Sample space S : the set of all possible outcomes.
- Event E : any collection (subset) of outcomes from S .
- Equally likely outcomes: outcomes having the same chance of occurring.

EXAMPLE - Tossing a Coin

One toss: $S = \{H, T\}$

Event "getting a head":

$$E = \{H\}$$



Outcome: H



Outcome: T

Rolling one fair die:



$$S = \{1, 2, 3, 4, 5, 6\}$$

Event "even number":

$$E = \{2, 4, 6\}$$

Probability describes how likely an event is; it does not predict the result of one particular trial.

THEORETICAL PROBABILITY

When all outcomes of a random experiment are equally likely,

$$P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Total number of possible outcomes}}$$

$$P(E) = \frac{n(E)}{n(S)}$$



Use this formula only when the outcomes are equally likely and the sample space is finite.

HOW TO FIND IT

- ① Write the complete sample space S .
- ↓
- ② Count $n(S)$, the total equally likely outcomes.
- ↓
- ③ Write event E and count favourable outcomes $n(E)$.
- ↓
- ④ Substitute in $P(E) = \frac{n(E)}{n(S)}$.
- ↓
- ⑤ Simplify the answer.

EXAMPLE - Drawing a Blue Token

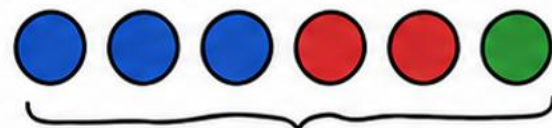
A bag has 3 blue, 2 red and 1 green identical tokens.
One token is drawn at random.

$$\text{Total tokens} = 3 + 2 + 1 = 6$$

$$\text{Favourable blue tokens} = 3$$

$$P(\text{blue}) = \frac{3}{6} = \frac{1}{2}$$

$$\text{ANSWER: } P(\text{blue}) = \frac{1}{2}$$



Six identical tokens;
only the colour differs.

“Favourable” means the outcomes that make the event happen; it does not mean “good”.

ELEMENTARY EVENTS & TOTAL PROBABILITY

DEFINITIONS

- Elementary event: an event containing exactly one outcome of the sample space.
- Compound event: an event containing more than one outcome.

Elementary events:

$E_1 = \{1\}$	→	$P(E_1) = \frac{1}{6}$
$E_2 = \{2\}$	→	$P(E_2) = \frac{1}{6}$
$E_3 = \{3\}$	→	$P(E_3) = \frac{1}{6}$
$E_4 = \{4\}$	→	$P(E_4) = \frac{1}{6}$
$E_5 = \{5\}$	→	$P(E_5) = \frac{1}{6}$
$E_6 = \{6\}$	→	$P(E_6) = \frac{1}{6}$

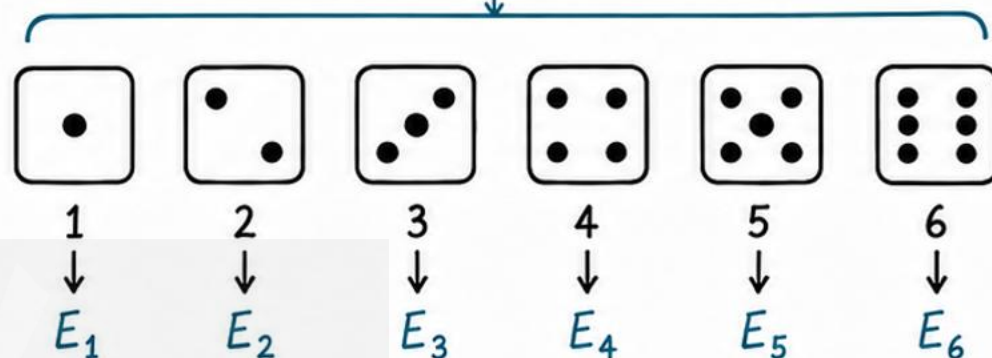
Probability:

Consider one fair die.

Sample space:

$$S = \{1, 2, 3, 4, 5, 6\}$$

SAMPLE SPACE S (all outcomes)



RESULT

The sum of the probabilities of all elementary events of an experiment is 1.

$$\begin{aligned} &P(E_1) + P(E_2) + P(E_3) + P(E_4) + P(E_5) + P(E_6) \\ &= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \\ &= \frac{6}{6} = 1 \end{aligned}$$

EXAMPLE - Even Number on a Die

Let $A = \text{"an even number"} = \{2, 4, 6\}$

$$\begin{aligned} P(A) &= P(\{2\}) + P(\{4\}) + P(\{6\}) \\ &= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{1}{2} \end{aligned}$$

★ An event can be formed by combining mutually exclusive elementary events.

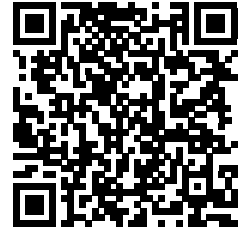


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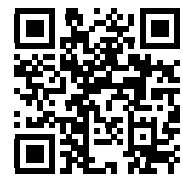


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