

## Probability

IGCSE Mathematics ■ Topic 8

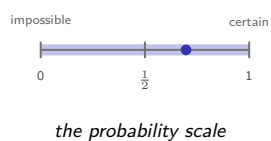
IGCSE Mathematics



Probability

### What we will cover

- 1 The probability scale
- 2 Relative & expected frequency
- 3 Combined events
- 4 Sample space diagrams
- 5 Venn diagrams
- 6 Tree diagrams

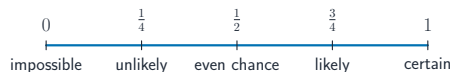


# 1

## Basics

## The probability scale

Probability runs from 0 (impossible) to 1 (certain), with  $\frac{1}{2}$  an even chance.



For equally likely **outcomes** 结果,

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

The probability that an event does **\*\*not\*\*** happen is

$$P(A') = 1 - P(A).$$

## Relative and expected frequency

**relative frequency** 相对频率

$\frac{\text{times it happened}}{\text{total trials}}$   
better with more trials

**expected frequency** 期望频数

$P \times n$ ; e.g.  $\frac{1}{6} \times 300 = 50$  sixes

## Combined events

**AND – multiply**

both happen, when **independent** 独立事件

**OR – add**

either happens, when **mutually exclusive** 互斥

# 2 Diagrams

Probability  
└ Diagrams

## Sample space diagrams

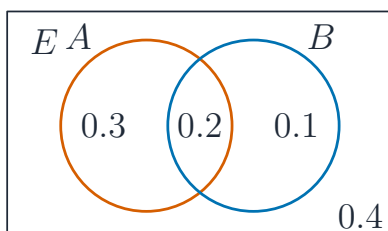
|       |   | die 2 |   |   |    |    |    |
|-------|---|-------|---|---|----|----|----|
| +     |   | 1     | 2 | 3 | 4  | 5  | 6  |
| die 1 | 1 | 2     | 3 | 4 | 5  | 6  | 7  |
|       | 2 | 3     | 4 | 5 | 6  | 7  | 8  |
|       | 3 | 4     | 5 | 6 | 7  | 8  | 9  |
|       | 4 | 5     | 6 | 7 | 8  | 9  | 10 |
|       | 5 | 6     | 7 | 8 | 9  | 10 | 11 |
|       | 6 | 7     | 8 | 9 | 10 | 11 | 12 |

the six highlighted cells all give a total of 7

A **sample space diagram** 样本空间图 lists every outcome in a grid. Two dice give 36 equally likely cells; count the ones you want.

Probability  
└ Diagrams

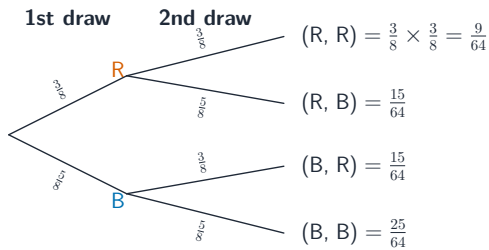
## Venn diagrams



A **Venn diagram** 维恩图 sorts outcomes into sets.

- $P(A \cap B)$  – in **both**
- $P(A \cup B)$  – in **either**

## Tree diagrams



On a **tree diagram** 树状图, **multiply** along branches & **add** the paths you want. Two reds (with replacement):  $\frac{3}{8} \times \frac{3}{8} = \frac{9}{64}$ .

# 3

## Recap

## Worked example – probability of 'not'

**A bag holds 3 red and 5 blue counters. Find the probability of *not* drawing red.**

- Total counters =  $3 + 5 = 8$ .
- $P(\text{red}) = \frac{3}{8}$
- $P(\text{not red}) = 1 - P(\text{red}) = 1 - \frac{3}{8} = \frac{5}{8}$
- Check: there are 5 blue out of 8 – the same answer, as it must be.

$P(\text{not } A) = 1 - P(A)$ . All probabilities lie between 0 and 1: a negative answer or one above 1 means you have made a slip.

## Topic 8 – key takeaways

### 1 Scale

0 to 1;  $P(A') = 1 - P(A)$

### 2 Expected

$P \times n$  over  $n$  trials

### 3 Combined

AND multiply, OR add

### 4 Trees

multiply along branches, add the paths

## Check yourself

- 1 What does probability 0 mean?
- 2 If  $P(A) = 0.3$ , what is  $P(A')$ ?
- 3 Do you add or multiply for AND?
- 4 What do you do along a tree branch?



**Answers** 1. impossible 2. 0.7 3. multiply 4. multiply the probabilities