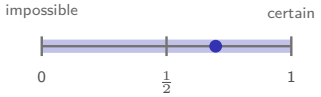
Probability

IGCSE Mathematics ▪ Topic 8

IGCSE Mathematics

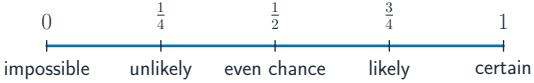
What we will cover

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



the probability scale

The probability scale



probability dice

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

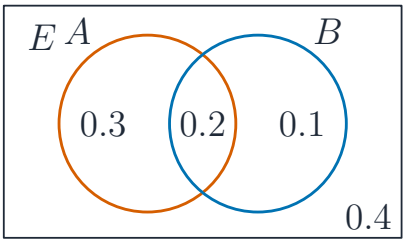
Sample space diagrams

	die 2					
die 1	**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

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.

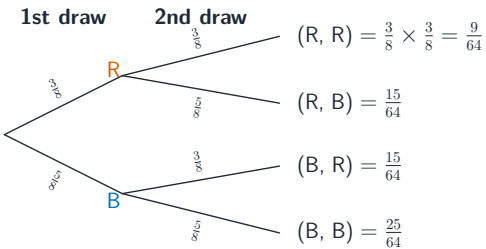
Venn diagrams



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

- $\mathrm{P}(A \cap B)$ – in both
- $\mathrm{P}(A \cup B)$ – in either

Tree diagrams



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

Worked example – probability of 'not'

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

- Total counters $= 3 + 5 = 8$.
- $P(\text{red}) = \dfrac{3}{8}$
- $P(\text{not red}) = 1 - P(\text{red}) = 1 - \dfrac{3}{8} = \dfrac{5}{8}$
- 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; $\mathrm{P}(A') = 1 - \mathrm{P}(A)$

2 Expected

$\mathrm{P} \times n$ over n trials

3 Combined

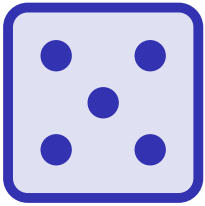
AND multiply, OR add

4 Trees

multiply along branches, add the paths

Check yourself

1. What does probability 0 mean?
2. If $\mathrm{P}(A) = 0.3$, what is $\mathrm{P}(A')$?
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