

5.3 Probability

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

KEY WORDS probability 概率 • independent 独立 • mutually exclusive 互斥
• conditional probability 条件概率 • independent events 独立事件

Objective

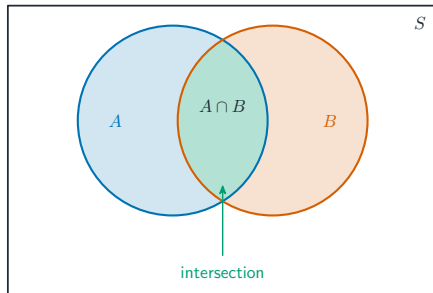
Build the skills to answer exam questions on **probability** 概率 — the addition and multiplication rules, **mutually exclusive** 互斥 and **independent** 独立 events, and **conditional probability** 条件概率.

You must be able to:

- use $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- test independence with $P(A \cap B) = P(A)P(B)$
- use $P(A | B) = \frac{P(A \cap B)}{P(B)}$

1 Worked examples

■ Rules & independence



The overlap is $A \cap B$; the addition rule subtracts it once so it is not double-counted

$P(A) = 0.5$, $P(B) = 0.4$, $P(A \cap B) = 0.2$. **Independent?** $P(A)P(B) = 0.2 = P(A \cap B)$ — yes.

Conditional: $P(A | B) = \frac{0.2}{0.4} = 0.5$.

2 Practice

2.1 Events are mutually exclusive with $P(A) = 0.3$, $P(B) = 0.45$. Find $P(A \cup B)$. [2]

2.2 State the test for two events A and B to be independent. [1]

3 Exam-style questions

3.1 For independent events with $P(A) = 0.6$ and $P(B) = 0.5$, $P(A \cap B)$ is: [1]

- **A** 1.1
- **B** 0.3
- **C** 0.1
- **D** 0

3.2 A and B are events with $P(A) = 0.6$, $P(B) = 0.5$ and $P(A \cup B) = 0.8$.

(a) Find $P(A \cap B)$. [2]

(b) Determine whether A and B are independent. [2]

(c) Find $P(A | B)$. [2]

3.3 A bag has 5 red and 3 blue balls. Two are drawn without replacement. Find the probability that both are red. [3]

Solutions

2.1 mutually exclusive $\rightarrow P(A \cup B) = 0.3 + 0.45 = 0.75$.

2.2 $P(A \cap B) = P(A) \times P(B)$.

3.1 B. $0.6 \times 0.5 = 0.3$.

3.2 (a) $0.8 = 0.6 + 0.5 - P(A \cap B) \Rightarrow P(A \cap B) = 0.3$.

(b) $P(A)P(B) = 0.6 \times 0.5 = 0.3 = P(A \cap B)$, so they **are** independent.

(c) $P(A | B) = \frac{0.3}{0.5} = 0.6$.

3.3 $P(\text{both red}) = \frac{5}{8} \times \frac{4}{7} = \frac{20}{56} = \frac{5}{14}$.