

## 2.4 Use probability rules, conditional information and counting

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 24 marks

**KEY WORDS** sample space 样本空间 • independent 独立 • conditional probability 条件概率

### Objective

Use probability rules, conditional information and counting. Original GAC004-aligned practice, not an official assessment. Show the method as well as the result. All applied scenarios are invented classroom problems.

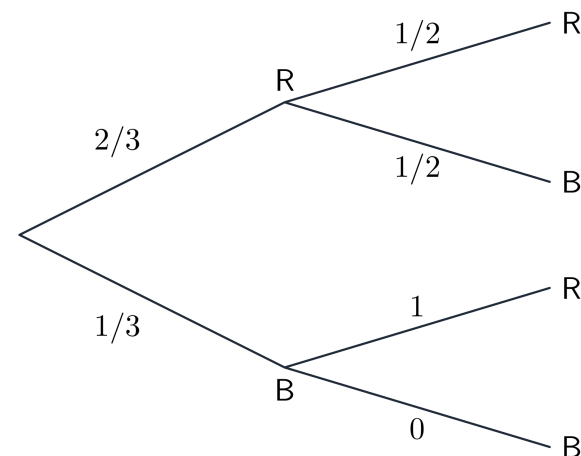
### 1 Key knowledge and worked examples

■ **Key knowledge: independence and mutual exclusion describe different relationships**

A **sample space** 样本空间 lists possible outcomes. For equally likely outcomes, probability is favourable count divided by total count. The complement has probability  $1 - P(A)$ . For any events,  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ .

Events are **independent** 独立 when one does not change the probability of the other; then  $P(A \cap B) = P(A)P(B)$ . Mutually exclusive events cannot occur together. **Conditional probability** 条件概率 uses  $P(A | B) = P(A \cap B) / P(B)$  for  $P(B) > 0$ . Sampling without replacement changes later probabilities. Ordered arrangements use permutations; unordered selections use combinations.

■ **Worked example: a second draw depends on the first**



Known: two red and one blue counter, two random draws without replacement. To get two reds, follow the red-red path and multiply its conditional probabilities.

$$P(RR) = P(R_1)P(R_2 | R_1)$$

$$P(RR) = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$$

A first blue leaves only red counters; the blue-blue path has probability zero. The draws are not independent.

### 2 Practice

2.1 A fair six-sided die is rolled once. Find the probability of a number greater than 4.[2]

---



---



---



---

**2.2** If  $P(A) = 0.35$ , find the probability of the complement of A. [2]

---

---

---

---

**2.3** Events have  $P(A) = 0.4$ ,  $P(B) = 0.5$  and  $P(A \cap B) = 0.2$ . Find  $P(A \cup B)$  and decide whether they are independent. [3]

---

---

---

---

---

---

**2.4** Five distinct students stand in a line. (a) Count the possible orders. (b) Count the possible unordered teams of two drawn from them. [3]

---

---

---

---

---

---

**3 Exam-style questions**

**3.1** A bag has 3 red and 2 blue counters. Two are drawn randomly without replacement. Find (a) the probability both are red and (b) the probability exactly one is red. Explain why the second draw cannot use the original proportions unchanged. [6]

---

---

---

---

---

---

---

---

---

---

[8]