

Exercise walk-through

Independent Events and Unions of Events ■ 4.6

eXercise

You must be able to

- describe **independence** 独立: $P(A \mid B) = P(A)$, so $P(A \cap B) = P(A) \cdot P(B)$
- apply the **addition rule** 加法法则, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Method — Independence

A and B are **independent** if knowing that one occurred does not change the probability of the other: $P(A \mid B) = P(A)$. Then

$$P(A \cap B) = P(A) \cdot P(B).$$

Method — The addition rule

For the **union** (A or B or both):

$$P(A \cup B) = P(A) + P(B) - P(A \cap B).$$

Practice 2.1 ■ 1 mark

State the condition for A and B to be independent.

Solution 2.1

Worked steps

knowing that one has occurred does not change the probability of the other **B1**.

Practice 2.2 ■ 2 marks

For independent events with $P(A) = 0.5$ and $P(B) = 0.4$, find $P(A \cap B)$.

Solution 2.2

Worked steps

$$P(A \cap B) = 0.5 \times 0.4 = 0.2 \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

Write the addition rule for $P(A \cup B)$.

Solution 2.3

Method: The addition rule

Worked steps

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \quad \text{B1}.$$

Exam-style 3.1 ■ 1 mark

For independent events, $P(A \cap B) =$

A $P(A) + P(B)$

B $P(A) \cdot P(B)$

C 0

D $P(A \mid B)$

Solution 3.1

A $P(A) + P(B)$

B $P(A) \cdot P(B)$



C 0

D $P(A | B)$

Worked steps

B.

Exam-style 3.2 ■ 1 mark

The addition rule is $P(A \cup B) =$

A $P(A) + P(B)$

B $P(A) + P(B) - P(A \cap B)$

C $P(A) \cdot P(B)$

D $P(A) - P(B)$

Solution 3.2

Method: The addition rule

A $P(A) + P(B)$

B $P(A) + P(B) - P(A \cap B)$



C $P(A) \cdot P(B)$

D $P(A) - P(B)$

Worked steps

B.

Exam-style 3.3 ■ 2 marks

$P(A) = 0.6$, $P(B) = 0.3$, and $P(A \cap B) = 0.2$.

(a) Find $P(A \cup B)$.

(b) State whether A and B are independent (check $P(A \cap B) = P(A) \cdot P(B)$).

Solution 3.3

Method: Independence

Worked steps

(a) $0.6 + 0.3 - 0.2 = 0.7$ **M1** **A1**. (b) no — $P(A) \cdot P(B) = 0.18 \neq 0.2$ **B1**.